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GUENNELON (G.) & TORT (M. J.). **Sur les facteurs de réduction naturelle des populations hivernantes d'*Archips rosana* Linné dans la Basse Vallée du Rhône (Lep. Tortricidae).**—*Bull. Soc. ent. Fr.* **63** no. 5–6 pp. 117–122, 3 refs. Paris, 1958.

The larvae of *Archips* (*Tortrix*) *rosanus* (L.) defoliate trees in orchards and windbreaks each spring in the lower Rhône valley of France. The Tortricid has only one generation a year and overwinters in the egg stage [*cf. R.A.E.*, A **44** 142, etc.]. Of the eggs not attacked by predators or parasites, about 85–100 per cent. hatched after the winters of 1952–53, 1953–54 and 1954–55, and about the same percentage after the exceptionally severe winter of 1955–56, during which minimum temperatures of −8 to −14°C. [17·6–6·8°F.] were recorded on 10th–14th February and mean temperatures of −2·5°C. [27·5°F.], −3·5°C. [25·7°F.] and 1·9°C. [35·42°F.] for the periods 1st–10th, 11th–20th and 21st–29th February, respectively. In laboratory experiments in February 1955, the hatch from post-diapause eggs was 93, 84, 45, 16 and 4 per cent. after exposure to a constant temperature of −8°C. for 1, 2, 3, 4 and 5 weeks, respectively, 89–94 per cent. after 1–5 weeks at 0°C. [32°F.], and 93, 90 and 90 per cent. after 1, 3 and 5 weeks, respectively, at 8°C. [46·4°F.]. It is concluded that the egg clusters are sufficiently protected against low temperatures by the sheltered positions in which they are laid and by the secretion with which they are covered at oviposition.

Orchards situated on the banks of the Rhône or its tributaries are subject to flooding in spring, and the eggs, which are laid mostly at the base of the trunks, then become submerged and remain covered by standing water even after the main flood has subsided. The hatching rate of eggs from an area to the north of Avignon that was flooded in the spring of 1955 varied between 0 and 90 per cent. Survival was shown in the laboratory to be inversely related to the period of submersion, the hatching rate falling from 80 per cent. after 1 day to 0 per cent. after 21 days at 8°C., as compared with 84–90 per cent. for unsubmerged controls.

Considerable mortality of eggs was caused by the predacious mite, *Allothrombium fuliginosum* Hermann, in January–February and by the parasite, *Trichogramma evanescens cacoeciae* Marchal, especially when they were laid on windbreaks.

MORETON (B. D.) & BRYDEN (J. W.). **Control of Apple Aphids and Caterpillars by Spring Washes.**—*Exp. Hort.* 1957 no. 1 pp. 43–50, 2 refs. London, 1957.

The effectiveness of sprays of DDT and BHC against aphids on apple in southern England [*cf. R.A.E.*, A **36** 131] was investigated in five counties in 1950–55, and the following is based almost entirely on the authors' summary and conclusions. Good control of the oat-apple aphid, *Rhopalosiphum insertum* (Wlk.) [of which Hille Ris Lambers considers *R. crataegellum* (Theo.) (*cf.* **19** 513; **35** 295) to be a synonym], and the green apple aphid, *Aphis pomi* Deg., was given by 0·1 per cent. wettable BHC and an emulsion spray of 0·1 per cent. DDT, with or without a proprietary spreader, applied at bud-burst. Reduction in infestation varied from about 97 to nearly 100 per cent., and was similar to that obtained with the standard dormant spray of 6 per cent. DNC. Later sprays of either insecticide, with the inclusion of 3 pints spreader per 100 gal. with the DDT, applied at the mouse-ear to pink-bud stages, gave more variable results, the reduction in infestation ranging from about 74 to 97 per cent. The sometimes inferior control given

by these sprays was probably due to the difficulty of reaching aphids concealed among young leaves and flower buds. Young apple leaves are also extremely difficult to wet. There was no evidence of any difference in effectiveness between DDT with the spreader and BHC at the same concentrations, and some that DDT was as effective at 0·05 as at 0·1 per cent. when applied at bud-burst. In a test including emulsion sprays of endrin and malathion, some evidence was obtained that the former applied at 0·025 per cent. at bud-burst and the latter at 0·1 per cent. at the mouse-ear stage could give control equal to that from BHC or DDT at bud-burst. A spray of 0·1 per cent. wettable DDT was about as effective as the emulsion spray at the same concentration. In another test, the emulsion spray of 0·1 per cent. DDT applied at bud-break, just after the aphids had begun to hatch, gave a high degree of control. Hatching was not complete for another 14 days, so that the DDT deposit remained effective over this period. In a test with low-volume sprays (50 gal. per acre), in which the same amount of insecticide as in the high-volume sprays, but only one-fifth the amount of water, was used per tree, and all of which included 5 per cent. lime-sulphur and the spreader at 3 pints per 100 gal., 0·5 per cent. BHC, or DDT and 0·125 per cent. endrin applied at the early green-cluster stage gave poor control, which was inferior to that given by a high-volume spray of 0·1 per cent. DDT.

Larvae of the winter moth [*Operophtera brumata* (L.)] and Tortricids were too few to enable satisfactory conclusions to be drawn, but there were indications that 0·2 per cent. BHC at the green-cluster stage gave poor control and that the emulsion spray of 0·1 per cent. DDT with the spreader, also at the green-cluster stage, gave a reduction comparable with that given by the dormant spray of DNC. Records for the apple sucker [*Psylla mali* (Schmidb.)] were obtained only in one test, in which numbers were low, but the regular sprays of 0·025 per cent. endrin at bud-burst and 0·1 per cent. malathion at the mouse-ear stage and the low-volume spray of 0·125 per cent. endrin at green-cluster gave good control.

It is concluded that the comparatively poor aphid control sometimes obtained with conventional BHC and DDT sprays applied later than bud-burst is commercially adequate in years when aphid numbers are low or moderate, but not in years, such as 1955, when infestation is severe. It is also unlikely to be adequate should infestations of the rosy apple aphid, *Anuraphis roseus* Baker (*Sappaphis mali* (Ferr.)), which are potentially more dangerous than those of *Aphis pomi*, increase to more serious proportions. There is evidence that success with sprays applied after bud-burst depends upon thoroughness of spraying, and it is not surprising that the rates commonly used in Kent gave results in 1955 that were frequently disappointing.

European and Mediterranean Plant Protection Organisation. **San José Scale in Europe and the Mediterranean Basin in 1956, 1957, 1958.** [*In English & French.*]—[3+] xiii + 12 pp.; [3+] 12 + x pp.; [3+] 12 + xi pp., multigraph. Paris, 1957, 1958, 1959.

The distribution and occurrence of *Quadraspidiotus* (*Aspidiotus*) *perniciosus* (Comst.) on fruit and other trees and bushes in Europe and North Africa is reviewed as for earlier years [*cf. R.A.E.*, A **44** 433]. There were no important changes in 1956 or 1957 in the countries previously considered, but some slight spread of the infested areas occurred in Portugal, Algeria and Switzerland in 1958 and infestation was moderately heavy. It is further stated in the report for 1957 that infestation was declining in Czechoslovakia and

Hungary and in that for 1958 that there was no change in the infested area in Rumania. In the Soviet Union, the scale was present in Moldavia, the Ukraine and several regions near the Caucasus and Black Sea in 1957, and there was no change in 1958. Control measures applied in various countries are reviewed.

European and Mediterranean Plant Protection Organisation. **Colorado Beetle in Europe in 1958.** [*In English & French.*]—[3+] 17 + xvi pp., multigraph. Paris, 1959.

The occurrence and distribution of *Leptinotarsa decemlineata* (Say) on potato in Europe in 1958 are surveyed as for the previous year [*cf. R.A.E.*, A **47** 210]. There was little change except in the central and eastern group of countries. There was some increase in the area infested in Poland and also in Yugoslavia, where infestation was intense. The beetle was reported for the first time from Rumania, probably as a result of migration from Yugoslavia and Hungary in early May, and infestation was heavy and widespread in the western districts. Surveys along the borders of the Soviet Union with Poland, Hungary and Czechoslovakia showed that the beetle was present in 5,320 fields, invasion having occurred from Hungary, Czechoslovakia and the Baltic Sea; the swarms arriving by sea probably originated in Poland and eastern Germany. Eggs, larvae and adults were found in Denmark, but the beetle is still considered not to have become established there [*cf. loc. cit.*]. The control measures applied in the various countries are reviewed.

Bel'kevich (V. I.). **Intensity of Feeding and Accumulation of Food Reserves in** *Eurygaster integriceps*. [*In Russian.*]—*Zool. Zh.* **36** pt. 4 pp. 515–520, 2 graphs, 11 refs. Moscow, 1957. (With a Summary in English.)

It is known that adults of *Eurygaster integriceps* Put. accumulate food reserves in the mid-gut before entering diapause [*cf. R.A.E.*, A **43** 123], but not when the process begins and ends. Investigations were therefore made in the Krasnodar region by weighing the mid-guts of examples caged on wheat. It was found that the intensity of feeding was closely related to the weather, being greatly reduced during rainy periods. It was greatest in the morning and evening hours, when humidity rose and air temperatures were moderate. The most favourable conditions were temperatures ranging from 18–20 to 28–30°C. [64·4–68 to 82·6–86°F.] and relative humidities ranging from 50–55 to about 100 per cent. During the period of " fat feeding ", the weight of the young adults increased rapidly. Food was always present in the first section of the mid-gut, but assimilation was rapid, the bugs losing up to 80 per cent. of their weight in a day when removed from their food. The females took more food than the males, but the rate of digestion was about the same for both. The weight of the mid-guts of week-old bugs that had already accumulated considerable amounts of fat was less than that of individuals only 3–4 days old, feeding having decreased in intensity and digestion having also decreased with the onset of the accumulation of food reserves. This began as soon as the bugs contained about 30 per cent. of their dry weight of fat. The food was stored in the mid-gut. Conservation processes set in about 4–5 days before flight from the fields, and the food

mass changed in consistency and colour 2–3 days after the cessation of feeding, the biochemical processes concerned consisting in the splitting of proteins and the hydrolisation of carbohydrates. The changes involved are discussed in some detail and seemed adapted to facilitate nutrition and reproduction in spring.

Chumakova (B. M.). **Parasites of Coccids in the Maritime Territory.** [*In Russian.*]—*Zool. Zh.* **36** pt. 4 pp. 533–547, 11 figs., 23 refs. Moscow, 1957. (With a Summary in English.)

Quadraspidiotus (*Diaspidiotus*) *perniciosus* (Comst.) is an important pest of fruit trees in the Maritime region of the Soviet Union, where the related *Q.* (*D.*) *gigas* (Thiem & Gerneck) and *Q.* (*D.*) *ostreaeformis* (Curt.) also occur. The most important of the Hymenopterous parasites of *Q. perniciosus* is *Prospaltella perniciosi* Tower, which was first observed there in 1950. The adults of both sexes of this are described, and it is stated that no differences were found between them and examples of the Aphelinid from the Caucasus and the United States. The parasite overwinters in the egg stage in the overwintering first-stage Coccids, and the adults emerge in June. The females produce 50–60 eggs each, and there are 3–4 generations a year, as compared with one of *Q. perniciosus*. Parasitism did not exceed 30 per cent. The other parasites described are the Encyrtid, *Euussuria pallipes*, gen. et sp.n., from *Q. perniciosus*, and *Prospaltella gigas* and *Aphytis diaspidioti*, spp.n., from *Q. gigas* on poplar. *Q. gigas* was also parasitised by an Aphelinid later described as *Pteroptrix longicornis* Nik. Notes on the habits of these are included, together with a key to the species of *Aphytis* of the group of *A. mytilaspidis* (LeB.), to which *A. diaspidioti* belongs. *Prospaltella* and *Pteroptrix* were the most important. *Azotus* sp., *Aspidiotiphagus citrinus* (Craw) and *Comperiella bifasciata* How. were reared in small numbers from *Q. gigas*. *Q. ostreaeformis* was parasitised by *Prospaltella gigas*, *Pteroptrix longicornis*, *Aphytis diaspidioti* and *Azotus* sp.

Since the form of *Prospaltella perniciosi* that occurs on *Q. perniciosus* in the Caucasus is unisexual, the Far Eastern form, which has males and presumably reproduces bisexually, should be introduced into the European parts of the Union, where males of the parasite are unknown, to increase the effectiveness of parasitism.

Churakov (A. M.). **The Acorn Weevil.** [*In Russian.*]—*Zool. Zh.* **36** pt. 5 pp. 700–714, 10 graphs, 15 refs. Moscow, 1957. (With a Summary in English.)

An insufficiency of acorns has interfered with the raising of stocks of oak for use in plantations and windbreaks in European Russia. Pests and diseases are mainly responsible, and *Curculio glandium* Marsham is the most important of the former. Observations in 1952–55 showed that the eggs of this weevil are laid in the acorns in July–September. The larvae hatch in 6–10 days and feed on the cotyledons for 30–37 days, after which they enter the soil, mostly in August and September, overwinter, and pupate in the following July–August. The pupal stage lasts 12–18 days, and the newly emerged adults remain in the pupal cells until the following spring. In tests, the larvae were unaffected by deposits of DDT or BHC, but the adults were fairly susceptible, and these materials should therefore be applied in aerosol form during the period of adult feeding and oviposition. DDT applied in this way by aeroplane gave good control in several tests.

Minder (I. F.). **Contributions to the Biology of the Pear Gall-mite (*Eriophyes pyri* (Pgst.) Nal.).** [*In Russian.*]—*Zool. Zh.* **36** pt. 7 pp. 1007–1015, 4 figs., 19 refs. Moscow, 1957. (With a Summary in English.)

Eriophyes pyri (Pgst.) is widely distributed on pear in the Soviet Union. Observations on its bionomics were made in 1954–55 in the Ryazan district, where 86 per cent. of the orchards in which pears are grown showed infestation and the mite also occurred in nurseries. The damage caused was considerable. The mites overwintered in the buds and resumed activity at the bud-burst stage of tree development in spring. They fed on the lower surfaces of the leaves, causing the development of galls, and when these were numerous the leaves dried up. The fruits were also attacked in the second half of June, when first-generation adults were present, galls appearing on them likewise. Such fruits did not reach full size, and were easily detached from the tree by the wind. Development was completed in 20–25 days, and there were only two generations a year, the mites moving to their overwintering sites from the end of July onwards. Males were rare and apparently played little part in reproduction. Differences were observed in the susceptibility of varieties of pear to infestation. *Typhlodromus rhenanus* (Oudm.) and larvae of *Arthrocnodax* sp. were observed preying on the mites in the galls, but little control was afforded. Of the recommended control measures, spraying with lime-sulphur in spring is considered the best.

Rŷvkin (B. V.). **Peculiarities of Outbreaks of *Lymantria dispar* and Factors determining them.** [*In Russian.*]—*Zool. Zh.* **36** pt. 9 pp. 1355–1358, 2 refs. Moscow, 1957. (With a Summary in English.)

Outbreaks of *Lymantria dispar* (L.) in forest districts in the Soviet Union are frequent and prolonged. One of the causes of this is the relative ineffectiveness of *Anastatus disparis* Ruschka, the principal parasite of the eggs. Observations in numerous areas in European Russia showed that this Eupelmid was not present in all of them and that parasitism by it rarely exceeded 5 per cent. Tachinid parasites of the larvae were also ineffective as a rule, but *Apanteles porthetriae* Mues. gave considerable larval mortality, and Sarcophagids reduced the numbers of prepupae and pupae, but were themselves parasitised. The effectiveness of *Anastatus* can be increased by collecting parasitised egg-masses of *L. dispar* in autumn, destroying the *Lymantria* larvae that hatch from them in spring and putting the remaining eggs in suitable containers that are then fastened to the trees; the adult parasites emerge in June. This method can also be used to introduce the parasite into areas in which it did not previously occur.

Kamenkova (K. V.). **Some Peculiarities of the Biology of *Eurygaster integriceps* Put. in the Foothill Zone of the Krasnodar Territory.** [*In Russian.*]—*Zool. Zh.* **36** pt. 10 pp. 1467–1474, 4 figs., 22 refs. Moscow, 1957. (With a Summary in English.)

Observations in the foothills of the Krasnodar region in 1950–52 showed that although eggs of *Eurygaster integriceps* Put. were laid in abundance on wheat in spring, the nymphs were less numerous than might have been expected and damage consequently less than in other areas. This was due to the activity of egg parasites, which were favoured by the presence of numerous other Pentatomids, notably *Dolycoris baccarum* (L.); the latter, unlike *E. integriceps*, has two generations a year. Parasitism of the eggs of *E. integriceps* reached 85–95 per cent.

JERMY (T.) & SÁRINGER (G.). **Die Rolle der Photoperiode in der Auslösung der Diapause des Kartoffelkäfers** (*Leptinotarsa decemlineata* **Say**) **und des Amerikanischen Weissen Bärenspinners** (*Hyphantria cunea* **Drury**). [The Rôle of Photoperiod in the Initiation of the Diapause of the Potato Beetle (*L. decemlineata*) and the American Fall Webworm (*H. cunea*).] —*Acta agron.* **5** fasc. 3–4 pp. 419–440, 14 figs., 29 refs. Budapest, 1955. (With Summaries in Russian & English.)

In Hungary, most of the first-generation females of *Leptinotarsa decemlineata* (Say) enter diapause without laying eggs, even though young potato leaves are available and the temperature is favourable. As it was thought that the daily period of light might be responsible, experiments were carried out in 1954. These showed that daily photoperiods of 14 or 17 hours caused no difference in the behaviour of overwintered females, but that the shorter period caused an increased number of those of the first generation to cease activity. Photoperiod during the larval stage had no differential effect, nor had potato foliage grown under the two conditions. Second-generation adults showed the same effect until the temperature fell, when all entered diapause. Females exposed to the short photoperiod during both the larval and adult stages laid fewer eggs than others.

Similar experiments with *Hyphantria cunea* (Dru.) showed that pupal diapause was largely prevented when second-generation larvae were exposed to a photoperiod of 17 hours a day, the food (mulberry leaves) having no effect.

MATOLCSY (G.) & SÁRINGER (G.). **Új inszekticidek korai zöldségfélék atka- és levéltetü-kártevői ellen.** [New Insecticides for the Control of Mites and Aphids on forced and early Vegetables.]—*Növénytermelés* **6** no. 2 pp. 165–174, 15 refs. Budapest, 1957. (With Summaries in Russian & English.)

Forced and early vegetables grown in Hungary are heavily infested by mites of the genus *Tetranychus* and aphids, and tests were carried out in 1957 with various phosphorus insecticides on red peppers (*Capsicum annuum*) to find a means of simultaneous control. DDVP (dimethyl 2,2-dichlorovinyl phosphate) proved the most effective of several materials used in sprays in a preliminary greenhouse test, but Dipterex (dimethyl 2,2,2-trichloro-1-hydroxyethylphosphonate) was almost as good and was preferred because of its low toxicity to man. In tests on a larger scale in hot-beds, in which Dipterex was applied at 0·1 per cent., control varied between 80 and 98 per cent., and there was no harmful effect on the flavour of the peppers. Less satisfactory results were obtained in the field, however, and it was concluded that the good control obtained under glass was due in part to a fumigant effect. When the compounds were tested as fumigants, they gave unequal results against the two pests, but a 1 : 3 mixture of γ BHC (87 per cent. pure) and Dipterex, used at 0·4 oz. per 1,000 cu. ft. in greenhouses gave 80 per cent. mortality of *Tetranychus* and complete kill of the aphids.

DOLINKA (B.). **A lencincér** (*Phytoecia coerulea* **Scop. Coleoptera, Cerambycidae**) **új magyar lenkártevő.** [*P. coerulea*, a new Pest of Flax in Hungary.]—*Növénytermelés* **7** no. 1 pp. 79–84. Budapest, 1958. (Abstr. in *Hung. agric. Rev.* **8** no. 1 p. 12. Budapest, 1959.)

Phytoecia coerulea (Scop.) was observed attacking flax for the first time in Hungary in 1956–57. The larvae of this Lamiid bore in the stems,

destroying the vascular bundles and causing the plants to break off. They pupate in the roots. The larval stage lasts about 15 months and the pupal stage 15–16 days, but the adults overwinter in the pupal cells, so that complete development requires two years.

Sacantanis (K. B.). **La forêt d'arganier. Le plus grand foyer de** *Ceratitis capitata* **Wied. connu au monde.**—*Boll. Lab. Ent. agr. Portici* **15** (1956–57) pp. 1–53, 12 figs., 18 refs. Portici, 1957.

The author describes the large forest of argan trees (*Argania*) that exists in Morocco, reviews the insects and other animals associated with it, and notes the factors that favour or disfavour infestation of the fruits by *Ceratitis capitata* (Wied.) [*cf. R.A.E.*, A **42** 406]. With a view to supplementing the local parasites of this Trypetid, five species of *Opius* were obtained from Hawaii and liberated in the forest in 1955. Preliminary estimation of the results was rendered difficult by the large quantities of insecticides distributed for the control of locusts. The other possible methods of control are cultural in nature, and further study of them is required, but there can be no doubt that control of the Trypetid in this important natural focus of infestation would be of advantage to Moroccan fruit-growers.

Russo (G.) & Santoro (R.). **Esperimenti di lotta antidacica eseguiti in Ascea Marina (Salerno) nel 1955.** [Experiments on the Control of *Dacus oleae* in Ascea Marina (Salerno) in 1955.]—*Boll. Lab. Ent. agr. Portici* **15** (1956–57) pp. 85–159, 26 graphs, 1 map, 10 fldg. tables. Portici, 1957. (With a Summary in English.)

Experiments on the control of *Dacus oleae* (Gmel.) on olive near Salerno were carried out in 1955, as in previous years [*cf. R.A.E.*, A **45** 131, etc.]. The weather was favourable for the Trypetid, and oviposition began in the groves in early July; infestation was heavy, but the population was kept in check by natural enemies, mainly *Prolasioptera berlesiana* (Paoli), which attacks the eggs; it reached its maximum in September and October.

A dust of 2 per cent. parathion applied on 5th September, when infestation had already begun but the larvae were still small, and again on 3rd and 27th October caused good mortality and resulted in 95 per cent. commercially sound olives on 22nd September and in 63·3 per cent. on 4th November, when all were infested on untreated trees. The addition of copper sulphate or copper oxychloride as an activator [*cf.* **45** 132] did not improve the results. In tests of high-volume emulsion sprays, treatment with 0·1 per cent. parathion on 5th September, alone or followed by a further application at 0·05 per cent. on 26th October, was of little use, but sprays of parathion at 0·075 per cent. on 5th September and 0·05 per cent. on 29th September resulted in 78·6 per cent. commercially sound olives on 4th November, as compared with 0 in the controls, and a further application at 0·05 per cent. on 28th October increased the figure to 91 per cent. Good results were also given by three applications at 0·05 per cent. The addition of 0·1 per cent. copper sulphate to sprays of 0·05 or 0·03 per cent. parathion increased their effectiveness, but a reduction of the concentration of parathion led to inferior control. Bordeaux mixture and copper oxychloride had a similar effect, but were inferior to copper sulphate. In low-volume emulsion sprays, 0·5 per cent. parathion with a wetting agent applied on 5th and 27th September gave excellent control until 18th October, and a third application on 26th October resulted in 88·3 per cent. commercially sound olives on 5th November. The addition of 0·1 per cent. copper sulphate permitted the

concentration of parathion to be halved in the later applications with no great loss of effectiveness, but not further reduced.

High-volume emulsion sprays of 0·1 per cent. diazinon (O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate), with a wetting agent, were applied on 6th and 28th September and 27th October and resulted in 97·3 per cent. commercially sound fruits on 5th November; the percentages were 80 and 80·3 when the concentration was reduced to 0·075 per cent. for the first application and 0·05 per cent. for the other two and to 0·05 per cent. for all three. It was observed that diazinon tended to increase the proportion of fallen infested fruits, as compared with parathion, so that the number of olives remaining on the tree was much reduced. This was apparently due to a failure to control all stages within the fruits. The addition of copper sulphate did not permit the concentration of diazinon to be reduced without loss of effectiveness. Combined schedules in which parathion was used in the early applications and diazinon in the later ones gave good results, but Dipterex (dimethyl 2,2,2-trichloro-1-hydroxyethylphosphonate), with or without copper sulphate, was ineffective. Treatment in late July with a combined spray of DDT (against the ovipositing adults) and parathion retarded the infestation, but gave insufficient control later in the season.

Russo (G.) & Santoro (R.). **Osservazioni bio-ecologiche ed esperimenti di lotta antidacica eseguiti in Ascea Marina (Salerno) nel 1956.** [Bio-ecological Observations and Experiments on the Control of *Dacus oleae* in Ascea Marina (Salerno) in 1956.]—*Boll. Lab. Ent. agr. Portici* **15** (1956–57) pp. 264–322, 5 figs., 10 fldg. tables. Portici, 1957. (With a Summary in English.)

Experiments on the control of *Dacus oleae* (Gmel.) near Salerno were continued in 1956 [*cf.* preceding abstract]. In that year, the hot dry summer delayed infestation, which did not become general until the second half of October, and favoured the parasites of the Trypetid. The results of the experiments are therefore regarded as indicative only.

An application of 0·5 per cent. DDT on 10th July, when oviposition was first observed, followed by one of 0·03 per cent. parathion with a wetter on 20th October, both in high-volume emulsion sprays, resulted in 96·3 per cent. commercially sound olives on 10th December, as compared with 81·3 per cent. for no treatment, and the addition of 0·1 per cent. copper sulphate to the parathion spray increased the percentage to 100, as compared with 88·3. A single spray of 0·03 per cent. parathion with 0·2 per cent. copper sulphate and a wetter applied on 20th October also gave good results, and 1 per cent. bordeaux mixture or copper oxychloride also increased the effectiveness of parathion.

In low-volume sprays, treatment with DDT on 11th July and 0·3 per cent. parathion with a wetting agent on 19th October resulted in 98·6 per cent. commercially sound fruits on 12th November, as compared with 87 per cent. for no treatment, but gave poor mortality within the olives; the addition of 0·5 per cent. copper sulphate slightly improved the results, but there was little advantage in increasing the parathion concentration to 0·4 or 0·5 per cent. A 2 per cent. parathion dust applied on 20th October gave fair control. In high-volume sprays, diazinon (O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate) gave good results at 0·1 per cent. when applied in October following a DDT spray in July; copper sulphate again failed to exercise an activating effect on it [*cf.* preceding abstract].

In tests of other materials, a high-volume emulsion spray of 0·005 per cent. Rogor (O,O-dimethyl S-(methylcarbamoyl)methyl phosphorodithioate) on 18th October resulted in 98 per cent. commercially sound fruits on 11th

December, as compared with 81·3 per cent. for no treatment, but gave insufficient mortality within them; increasing the concentration to 0·03 per cent. was still unsatisfactory, but an increase to 0·06 per cent. resulted in high mortality in the fruits for 25 days. A dust containing 3 per cent. of this compound was rather less effective. Sprays of 0·2–0·4 per cent. Dipterex (dimethyl 2,2,2-trichloro-1-hydroxyethylphosphonate) gave fair results, mortality increasing with the concentration. In a comparison of various phosphorus compounds in the same olive grove, sprays of 0·06 per cent. Rogor, 0·4 per cent. Dipterex, 0·06 per cent. diazinon and 0·05 per cent. parathion, the last with 0·1 per cent. copper sulphate, applied in late October, gave 100, 99·6, 89·3 and 92·6 per cent. commercially sound fruits, respectively, on 13th November, as compared with 88·3 per cent. for no treatment, and 88·4, 63·1, 66·6 and 88·3 per cent. mortality of *Dacus* within the fruits, as compared with less than 10 per cent.

Cavalli (L. M.). **Una straordinaria comparsa di** *Pachyrhina pratensis* **L. (Diptera-Tipulidae) nel territorio di Piacenza.** [An unusual Outbreak of *Nephrotoma pratensis* in the Territory of Piacenza.]—*Boll. Lab. Ent. agr. Portici* **15** (1956–57) pp. 180–186, 5 figs. Portici, 1957. (With a Summary in English.)

An outbreak of *Nephrotoma* (*Pachyrhina*) *pratensis* (L.) in the district of Piacenza caused heavy damage to young peas in March 1955. The life-history of this Tipulid, which has one generation a year, is briefly described. The adults appear towards mid-April and are active during the day, and especially in the evening, throughout May. They pair, and the females lay 250–280 eggs each in the soil. It is not known when the eggs hatch, but they probably undergo a considerable period of aestivation. In spring, the larvae are present in the upper layers of the soil and attack the root-collars and lower leaves of the plants. The pupal stage lasts about 10 days. Dusting the soil with BHC at rates of 36–45 lb. per acre and working it in gave satisfactory control.

Roberti (D.). **L'***Agrotera nemoralis* **Scop. (Lepidoptera-Pyralidae) dannosa al castagno.** [*A. nemoralis* harmful to Chestnut.]—*Boll. Lab. Ent. agr. Portici* **15** (1956–57) pp. 187–196, 7 figs. Portici, 1957. (With a Summary in English.)

An outbreak of *Agrotera nemoralis* (Scop.) began on chestnut growing over a considerable area on the hills to the north-west of Naples in 1951. It reached its peak in 1953, when the trees were almost completely defoliated, and much less damage was caused in 1954. Hornbeam was also attacked. The larva, pupa and adults of both sexes of this Pyralid are described, and observations on its bionomics, made in 1953, are recorded. There were apparently several overlapping generations in the year, all stages being present together in summer. The larvae fed in groups between two leaves tied together, consuming all but the veins, and pupated in pockets formed by cutting and bending over a portion of the edge of a leaf Full-fed larvae collected in early August gave rise to adults about 12 days later. Adults were rare towards mid-September, and larvae collected then pupated and gave rise to adults in the following May. The Pyralid is normally kept in control by natural enemies, and the outbreak was evidently due to a temporary diminution in their activity. In September 1953, 50 per cent. of the larvae were found to be parasitised by *Microgaster* sp.

Lauricella (S.). **Reperti sull'ibernazione di alcuni coccidi-diaspini in Campania.** [Observations on the Overwintering of some Diaspine Coccids in Campania.]—*Boll. Lab. Ent. agr. Portici* **15** (1956–57) pp. 197–220, 5 graphs, 15 refs. Portici, 1957. (With a Summary in English.)

Deciduous fruit trees in Campania are infested by *Quadraspidiotus* (*Comstockaspis*) *perniciosus* (Comst.), *Parlatoria oleae* (Colv.), *Pseudaulacaspis* (*Diaspis*) *pentagona* (Targ.) and *Epidiaspis* (*D.*) *leperii* (Sign.), of which *Q. perniciosus* is the most important. The bionomics of *Q. perniciosus*, which has several generations a year, are reviewed, and investigations in 1954–56 on the stages in which all four species overwinter are recorded. *Q. perniciosus* overwintered predominantly as first-stage nymphs, which moulted when the average daily temperature reached 12–13°C. [53·6–55·4°F.]. The other three overwintered as adult females. *Parlatoria pergandii* Comst., a heavy infestation by which was found on *Citrus* in 1955, overwintered mainly as adult females but also as second-stage nymphs.

Frediani (D.). **Note sulla** *Thyraeella collaris* **Grav. (Hymenoptera Ichneumonidae) parassita dell'***Acrolepia assectella* **Zell. in Toscana.** [Notes on *T. collaris*, a Parasite of *A. assectella* in Tuscany.]—*Boll. Lab. Ent. agr. Portici* **15** (1956–57) pp. 231–245, 10 figs., 17 refs. Portici, 1957.

Thyraeella collaris (Grav.), which was observed parasitising *Acrolepia assectella* (Zell.) on leeks and onions near Pisa in 1952–53 [*cf. R.A.E.*, A **44** 198], had not previously been recorded from this moth, and observations on its bionomics were therefore made then and in 1955–56. The larva, pupa and adults of both sexes of the Ichneumonid are described. It apparently had 4–5 generations a year. The adults emerged between the end of May and the beginning of November and survived for 6–8 days in the laboratory. The eggs were laid in the prepupae and young pupae, one per host, and the larval and pupal stages lasted about 15 and 6–8 days, respectively. The percentage parasitism, which was 0·4 in 1952 (and not 0·1 as previously stated by the author [*loc. cit.*]) and 11·4 in 1953, fell to 10·4 in 1955 and 4·8 in 1956. In September in 1953 and 1955, *T. collaris* was itself parasitised by *Eupteromalus nidulans* (Först.).

Roberti (D.). **Identità specifica della** *Mayetiola* **vivente sul grano in Europa e nel nord America.** [Specific Identity of *Mayetiola* living on Wheat in Europe and North America.]—*Boll. Lab. Ent. agr. Portici* **15** (1956–57) pp. 257–263, 3 figs., 4 refs. Portici, 1957. (With a Summary in English.)

From a comparison of descriptions and the characters of adults of both sexes obtained from wheat in Indiana (United States) and Campania (Italy), the author agrees that *Mayetiola secalis* Bollow, a name that was proposed for the European form, is a synonym of *M. destructor* (Say) [*cf. R.A.E.*, A **44** 194; **47** 277].

Labeyrie (V.). **Remarques sur la mise au point d'un élevage semi-industriel de** *Macrocentrus ancylivorus* **Roh.**—*Entomophaga* **2** no. 4 pp. 271–281, 5 figs., 23 refs. Paris, 1957. (With Summaries in English & Spanish.)

The author discusses the technique of Finney, Flanders & Smith [*R.A.E.*, A **39** 279] for the mass rearing of *Gnorimoschema operculella* (Zell.) and its

Braconid parasite, *Macrocentrus ancylivorus* Rohw., for release of the latter against *Cydia* (*Grapholitha*) *molesta* (Busck) in France and describes modifications of it designed to allow an output of 280,000 cocoons of *M. ancylivorus* per month by a single assistant and reduce the incidence of diseases. Females of *G. operculella* fed on sugared water to which a preparation for disease control was added laid about 300 eggs each in four days [*cf.* **46** 459]. Rearing cages, used for all stages of the process, were constructed from plastic materials; they were kept together in a relative humidity of 80 per cent., and separate cages used for each batch and stage of development. Strict hygienic measures were enforced, and as sodium hypochlorite was found to repel females and thus hinder pairing, 0·1 per cent. potassium permanganate was added to the water used in the final washing of the *Macrocentrus* cocoons, so as to neutralise it. The cocoons could be kept for a month at 10–15°C. [50–59°F.] and 70 per cent. relative humidity.

Benassy (C.). **Influence du facteur "exposition" sur la répartition des microhyménoptères parasites de Coccoidea-Diaspididae.**—*Entomophaga* **2** no. 4 pp. 283–291, 2 figs., 6 refs. Paris, 1957. (With a Summary in English.)

The rate of parasitism of hibernating females of *Pseudaulacaspis pentagona* (Targ.) by *Aphytis proclia* (Wlk.) and *Prospaltella berlesei* (How.) in peach orchards in the Var valley of France varied on different trees in February 1955 between 5·7 and 15·6 per cent. and 5·2 and 50 per cent., respectively, and that of the Coccid on mulberry by *P. berlesei* near Lyons between 0 and 54·8 per cent. Reasons for the great difference in attack by *P. berlesei* were investigated on mulberry at the latter place in 1955. Emerging adults of *P. berlesei* were confined on 10th March on the branches infested by *Pseudaulacaspis pentagona* on which they had developed, and analysis of counts made on 6th–7th June showed no significant differences between the numbers of the Coccid and its parasite on separate branches of the same tree. Populations of the first summer generation were later confined on branches having different orientations, and subsequent analysis of the counts of hosts and parasites showed that nearly twice as many parasites occurred in shaded situations as in those receiving direct sunlight.

Michel (É.). **Essai d'insecticides contre le ver jaune en 1956.**—*Ann. Inst. exp. Tab. Bergerac* **2** no. 4 pp. 93–100, 2 figs., 5 refs. Bergerac, 1957. (With a Summary in English.)

In tests of insecticides for the protection of tobacco plants against wireworms conducted at Bergerac, in central France, in 1956, 88·5 per cent. reduction in attack was given by dusting the roots before transplanting with a proprietary mixture containing 0·57 per cent. lindane [almost pure γ BHC] and 4·31 per cent. halogenated terpene hydrocarbons at a rate affording about 1·7 lb. per acre, and a dust of 1·25 per cent. γ BHC alone at 1·17 lb. was almost as effective; 3 per cent. aldrin and 0·8 per cent. parathion, both at about 2 lb. per acre, gave 72·5 and 68·5 per cent. reduction, respectively. A mixture of 1·82 per cent. γ BHC with 4·09 per cent. halogenated terpene hydrocarbons at 45 lb. per acre gave 83·6 per cent. protection as a dry soil treatment before planting, but was no more effective than, and three times as costly as, a dust containing 25 per cent. γ BHC applied at 18 lb. per acre, which had given good results in earlier years. Spraying the seedbed before transplanting gave less satisfactory results; γ BHC alone at 0·29 oz., γ BHC with dieldrin at 0·17 and 0·29 oz., respectively, and γ BHC with halogenated

terpene hydrocarbons at 0·08 and 2·3 oz., respectively, per 10 sq. yards in emulsion sprays gave 81·5, 78·5 and 66·5 per cent. protection, respectively, and a spray of wettable and emulsifiable parathion at 0·09 oz. only 59 per cent. The dust of γ BHC and halogenated terpene hydrocarbons and the spray of γ BHC and dieldrin caused no damage to the plants, whereas γ BHC alone induced transitory leaf deformation in 10 per cent. of them.

Michel (É.). **Toxicité de divers insecticides de synthèse vis-à-vis des " vers gris " s'attaquant au tabac.**—*Ann. Inst. exp. Tab. Bergerac* **2** no. 4 pp. 101–110, 8 graphs, 4 refs. Bergerac, 1957. (With a Summary in English.)

Larvae of *Agrotis* (*Euxoa*) *segetum* (Schiff.), found together with other cutworms injuring tobacco at Bergerac, in central France, were kept without food for a period and used in the laboratory in 1955–56 to assess the action of various chlorinated-hydrocarbon insecticides in dusts. It was confirmed that DDT acted mainly by contact and dieldrin and toxaphene by ingestion, and that aldrin and endrin were toxic by both routes. In a field test against cutworms in 1955, dusts of 1 per cent. endrin, 5 per cent. DDT and 5 per cent. aldrin gave 75, 69·5 and 69·2 per cent. control, respectively, as determined by Abbott's formula [*cf. R.A.E.*, A **13** 331]. It is recommended that contact poisons should be broadcast over the soil surface in dusts, and not applied only at the base of the plants.

Long (D. B.). **Host Plant Location by Larvae of the Wheat Bulb Fly** (*Leptohylemyia coarctata* **Fallén**).—*Proc. R. ent. Soc. Lond.* (A) **33** pt. 1–3 pp. 1–8, 3 figs., 9 refs. London, 1958.

The following is substantially the author's summary. The mechanism by which newly hatched larvae of *Hylemyia* (*Leptohylemyia*) *coarctata* (Fall.) find the wheat plants on which they feed was studied by introducing larvae into the soil in pots containing prepared young plants and by direct observations of movement in petri dishes. The results of the pot experiments suggested that the larvae move upwards at a fairly steep angle from the egg site and then horizontally in the surface layers of soil. They appeared to find the plants as the result of a response to an attractant material exuding from them. The root extremities were not involved in this process, but when roots close to the base of the plant were exposed to the larvae, appreciable infestation occurred. The highest level of infestation occurred in plants of which the stems only were exposed, indicating that these played the major part in the location mechanism and that the attractive root zone may actually interfere with infestation. The attractiveness of the exudates from the root and stem regions was supported by direct observation of larval movements in petri dishes. Leaf-tip exudates in the form of guttation droplets were also found to be attractive and may, on reaching the soil, reinforce the stem exudates. The attractiveness of the exudates was reduced by boiling.

Kelsey (J. M.). **Symbiosis and** *Anobium punctatum* **de Geer.**—*Proc. R. ent. Soc. Lond.* (A) **33** pt. 1–3 pp. 21–24, 2 refs. London, 1958.

The following is virtually the author's summary. Experiments are described indicating that there is a close relation between the presence of yeast cells on the eggs and optimum development of the larvae of *Anobium punctatum* (Deg.), though the larvae were able to survive on a low nutritional plane for 17 months in the absence of yeast cells.

Woodroffe (G. E.). **The Mode of Reproduction of** *Ptinus clavipes* **Panzer form** *mobilis* **Moore** (= *P. latro* **auct.**) (**Coleoptera: Ptinidae**).—*Proc. R. ent. Soc. Lond.* (A) **33** pt. 1–3 pp. 25–30, 9 refs. London, 1958.

The following is based on the author's summary. Breeding experiments designed to investigate the mode of reproduction of *Ptinus clavipes* form *mobilis* Moore, which exists only as gynogenetic females [*cf. R.A.E.*, A **46** 357] are described. It was established that the females will reproduce only after mating with males of *P. clavipes* Panz., *P. pusillus* Sturm or *P. fur* (L.) [*loc. cit.*], but the numbers of larvae produced in crosses with males of the three species varied and, in standard cultures containing 30–50 females, were about 2,000, about 100 and 2, respectively. The progeny were all referable to *mobilis*. When the females experienced repeated mating, egg viability was normal for a Ptinid. A very small proportion of the eggs laid by unmated females, which oviposited only under very crowded conditions, showed some development, but none hatched. A remarkably vigorous mating response existed between females of *mobilis* and males of *P. clavipes* and *P. pusillus* and was associated with a definite behaviour pattern on the part of the *mobilis* females. An experiment with sterilised males showed that viable sperm was essential for effective reproduction. In a discussion of the evolutionary significance of the unusual method of reproduction, it is pointed out that there are no reliable records of *mobilis* from entirely natural habitats.

Greathead (D. J.). **Notes on the Larva and Life History of** *Cyrtonotum cuthbertsoni* **Duda** (**Dipt., Drosophilidae**), **a Fly associated with the Desert Locust** *Schistocerca gregaria* (**Forskål**).—*Ent. mon. Mag.* **94** no. 1125 pp. 36–37, 1 pl., 4 refs. London, 1958.

Insects found feeding in the egg-pods of *Schistocerca gregaria* (Forsk.) on the coastal area of Eritrea during the winters of 1953–54, 1955–56 and 1956–57 included various Dipterous and Coleopterous larvae in addition to *Systoechus* spp., *Stomorhina lunata* (F.) and *Trox procerus* Har. [*cf. R.A.E.*, A **47** 54]. The Dipterous larvae mostly fed on decaying eggs or were general soil predators, and one of the commonest was *Curtonotum cuthbertsoni* Duda, which is also known from Southern Rhodesia and Kenya; descriptions of the larvae of this Drosophilid are included. Adults were observed at two places on dung, dead locusts and sand wetted by camel urine, and the females oviposited on egg-pods crushed and exposed during sampling. The larvae, of which there were over ten per pod, were generally found feeding in the top layers of eggs, which they reduced to a decaying mass. Pupation took place in this mass as it dried, or in the soil within an inch of it. At both places, the egg stage of the locust lasted 13–14 days. Larvae of *C. cuthbertsoni* were first found in numbers on the eighth day, when most were in the third (last) instar, and they were present until the locusts hatched and observations ceased. Puparia were first found nine days after the locust eggs were laid, and adults emerged from them 23–25 days later. At one place, *C. cuthbertsoni* attacked 3·6 per cent. of the egg-pods and at the other, where other species were confused with it, the combined attack was only 1·9 per cent.; of the pods attacked, 59·1 and 55·4 per cent., respectively, were first damaged by other predators, chiefly *S. lunata*.

Popov (G. B.). **Note on the Frequency and the Rate of Oviposition in Swarms of the Desert Locust** (*Schistocerca gregaria* **Forskål**).—*Ent. mon. Mag.* **94** no. 1131 pp. 176–180, 3 figs., 11 refs. London, 1958.

During laboratory experiments with *Schistocerca gregaria* (Forsk.) already noticed [*R.A.E.*, A **47** 55], the number of egg-pods laid each day in standard

breeding cages containing about 50 adults of each sex in phase *gregaria* showed fairly regular fluctuations, with three peaks during 20 days, which corresponds well with the average of about one egg-pod per female per week previously recorded for crowded females of *gregaria* under similar conditions [**40** 401]. Methods of estimating the rate of oviposition in the field from daily counts of ovipositing females or from the condition and rate of development of the ovaries, developed for *Dociostaurus maroccanus* (Thnb.) [*cf.* **47** 10] and *Nomadacris septemfasciata* (Serv.) [*cf.* **46** 252], respectively, in both of which maturation is synchronised, are not applicable to *S. gregaria*, in which synchronisation is often confused by the extreme mobility of the species, the heterogeneity of its habitats and irregularities in the weather. This is especially true of scattered, non-swarming populations, in which attempts to assess the rate and frequency of oviposition by sampling or direct observation have failed and for which laboratory observations provide the only guide [*cf.* **40** 401]. In swarming populations, maturation is usually rapid and synchronised in any one swarm, however, and records for several swarms can readily be combined, provided that they originate from the same area and travel together. Analysis of data obtained from an isolated swarm that had originated in north-eastern Kenya in April–May 1954, subsequently flew to the Karamoja highlands, reappeared in north-eastern Kenya at the beginning of August, when no other swarms were present, and broke up into smaller swarms, indicated two peaks of oviposition of almost equal intensity on 6th and 12th August and a much smaller third one about 18th August. Similar analysis of the earlier breeding in April–May, when the swarms were more varied in origin, also indicated three oviposition peaks, at intervals of about nine days, although the period of oviposition was more prolonged and the peaks were less clearly defined. The longer intervals may have been associated with the lower temperatures and sparser, drier vegetation at that season. Analysis of similar data for breeding during September–January in the Somali Peninsula, which follows a fairly regular seasonal pattern [*cf.* **36** 123], over the period 1952–54 showed agreement between the results for the first two seasons, with three peaks of oviposition and possibly further laying on a small scale; irregular rains and a more prolonged maturation period obscured the results for the third.

Hudleston (J. A.). **Some Notes on the Effects of Bird Predators on Hopper Bands of the Desert Locust** (*Schistocerca gregaria* **Forskål**).—*Ent. mon. Mag.* **94** no. 1132 pp. 210–214, 6 refs. London, 1958.

The author records observations on the effects of predacious birds, representing at least 20 species, a list of which is given, on a small gregarious population of hoppers of *Schistocerca gregaria* (Forsk.) in Ethiopia in November 1955. The birds fed at all times of day, though the smaller ones were often absent during the hottest part. Methods of attack, which are described, varied with the size of the bird and the location of the hoppers. Small birds tended to feed only on stragglers, but sometimes caused temporary dispersal by attacking marching hoppers at the edges of bands or roosting hoppers in bushes, and the direction of one marching band was altered by birds attacking the leading hoppers. The larger birds, notably ravens (*Corvus*) and hornbills (chiefly *Tockus erythrorhynchus*), often caused considerable dispersal and change of direction, and also herded the hoppers, especially when the latter were inactive, into bushes or grass tufts [*cf. R.A.E.*, A **42** 231; **46** 471]. In several experiments, in each of which 400–500 hoppers, which subsequently behaved as a band, were released in the evening in a bush, all were destroyed by birds within 1–3 days; during this period the birds caused some dispersal, which, however, was never complete.

Of a group of 450 hoppers released, 267 were seen to be eaten by birds. The numbers of hoppers in the alimentary tracts of four ravens that were shot while attacking bands varied from 11 to 84, and it was estimated that some 200,000 hoppers in the fourth and fifth instars that were attacked by about 400 ravens and about 200 hornbills would have been destroyed by the ravens alone in at most ten days. This band continued marching in the same direction, despite attacks, until its numbers were reduced to 50,000, when the hoppers sheltered in bushes and grass tufts; on the fourth day, only some 8,000 were left, and these were herded into two bushes by ravens. Numerous bands of up to 10,000 recently hatched hoppers were destroyed by predators, mainly small birds, in two weeks. Attack by birds on so large a scale had not previously been observed, and its effect on hopper populations was marked. Bird numbers probably increased during 1951–54, when locusts were numerous, and were sufficiently high in 1955, when hoppers were relatively scarce, to enable the birds to destroy the bands. During heavy infestation by *Schistocerca*, the effects of birds, though still probably considerable, would be less evident.

Green (A. A.) & Kane (J.). *Lasius brunneus* (**Latr.**) (**Hym., Formicidae**) **as a domestic Pest.**—*Ent. mon. Mag.* **94** no. 1131 p. 181, 3 refs. London, 1958.

Kane (J.) & Tyler (P. S.). **Domestic Infestations by** *Lasius brunneus* (**Latr.**) (**Hym., Formicidae**).—*T. c.* no. 1135 p. 286, 1 ref. 1959.

It is stated in the first of these notes that a nest of *Lasius brunneus* (Latr.), an ant that normally infests trees, especially oak, was found in May 1957 in the ceiling space of a sun-room attached to a house in Surrey, in deal beams that had rotted through close proximity to a leaking drain-pipe. The ants had been present in the house for 4–5 years, and sporadic outbreaks had occurred, unrelated to season. One beam was infested with larvae and pupae along a length of about 5 ft., and frass and dead ants were tightly packed between beams and in crevices for distances of up to 12 ft. from the nest. Foraging trails extended at least 50 ft. into all parts of the house and into the soil surrounding it, but the ants, which fed on a variety of foodstuffs, did not take honey or meat baits placed less than 15 ft. from the nest. The infestation was controlled by spraying the nest and much of the woodwork in the house with 2 per cent. chlordane in kerosene. Similar infestations are recorded from two places in Berkshire, and another occurred in the cork lining of a domestic refrigerator. It appears that the ant may be becoming established as a pest in buildings in Britain.

In the second note, two infestations of buildings by *L. brunneus* are reported from Slough, Buckinghamshire. At one, the foraging ants were a nuisance in a canteen, which they had invaded from surrounding woodland; they were controlled by an emulsion spray containing 2 per cent. chlordane applied to the outside walls of the canteen and to the ground and vegetation within about 6 ft. of it. The other was in a house, in which winged adults emerged in June from behind skirting boards in two rooms of which the outside walls were very damp.

Breese (M. H.) & Wise (T. E.). **The Biology of** *Nausibius clavicornis* (**Kug.**) (**Col., Cucujidae**).—*Bull. ent. Res.* **50** pt. 2 pp. 237–258, 9 figs., 19 refs. London, 1959.

The following is based partly on the authors' summary. *Nausibius clavicornis* (Kug.) is a cosmopolitan Cucujid that has frequently been recorded

from sugar [*cf. R.A.E.*, A **11** 60]. It is commonly found in this commodity in Trinidad, where it has not been collected from any other. All stages are described, and an account is given of its life-history based on laboratory studies in Trinidad in which the Cucujid was reared at 85°F. and 75 per cent. relative humidity on a food medium prepared according to Haydak's formula [**25** 187]. Development on two types of unrefined sugar was also studied. Mating took place within a day of the emergence of either sex, and the female began oviposition within four days of pairing. The average number of eggs laid was 275, and the over-all viability was 85 per cent. The average incubation period was just under five days. The larvae of both sexes sometimes underwent only five moults, but the more usual number for females was six. When the larvae were disturbed during development, larvae of both sexes tended to have six instars. Severe disturbance sometimes induced a seventh moult. The mean development period from oviposition to the emergence of the adult was 30 days when there were five larval instars and about two days more when there were six. Mortality was low on the artificial food medium. Ovipositing females lived for up to 163 days under controlled conditions, and the males tended to outlive them by about 50 days.

On raw or yellow-crystal (Demerara) sugar, adults survived for almost as long as on the artificial food medium (an average of 73 instead of 99 days), but oviposition was greatly reduced and the viability of the eggs was much lower. Larval mortality was high, especially in the first instar, and the duration of development was greatly increased. Only one individual (on Demerara sugar) reached the pupal stage, in which, however, it died.

From a half-bag (57 lb.) of naturally infested yellow-crystal sugar that had been in store for nine months, totals of 121 adults, 91 larvae, one pupa and one egg were collected. Most of the larvae were in the last (sixth) instar, and four of them pupated, but only two gave rise to adults. It is therefore unlikely that *N. clavicornis* could multiply rapidly in raw or unrefined sugar, and any deterioration in stored sugar directly attributable to it would probably be small in comparison with that caused by other factors.

Bünzli (G. H.) & Büttiker (W. W.). **A comparative Study of the Soil Conditions favoured by certain Melolonthid and Tenebrionid Pests of Tobacco in Southern Rhodesia.**—*Bull. ent. Res.* **50** pt. 2 pp. 259–263, 1 graph, 1 ref. London, 1959.

The following is based on the authors' summary. In an investigation of the factors governing the distribution in the soil of certain Lamellicorn and Tenebrionid larvae that are pests of tobacco in Southern Rhodesia [*cf. R.A.E.*, A **46** 408], observations were made on mixed populations of the Lamellicorns, *Anomala exitialis* Pér. and *Schizonycha profuga* Pér., and of the Tenebrionids, *Psammodes similis* Pér. and *P. scrobicollis* (Fhs.). The habitats favoured by the Lamellicorns were found to contain more clay, silt and organic matter than those favoured by the Tenebrionids. The clay ratio between the two types of habitat was 1:0·725 and the nitrogen ratio 1:0·524. Up to 60,000 or more Lamellicorns were found per acre in heavy infestations, but not more than 1,500 Tenebrionids. The Lamellicorns complete their life-cycle in one year, the larvae obtaining the food necessary for their development during the 4–5 months of the wet season. The Tenebrionids have a two-year life-cycle, and the active feeding periods of the larvae are spread over 18–21 months, comprising both wet and dry seasons. Infestations by the two groups of insects do not overlap to any great extent, but are governed by the nature of the soil, the Lamellicorns favouring areas in which the soil has a higher nutrient value and the Tenebrionids those in which it is poorer. The Lamellicorn larvae were parasitised by *Tiphia* sp.

in one area in which the soil had an abnormally high nitrogen content and by entomogenous fungi in another [*cf.* **47** 167].

Das (G. M.). **Bionomics of the Tea Red Spider,** *Oligonychus coffeae* **(Nietner).**—*Bull. ent. Res.* **50** pt. 2 pp. 265–274, 24 refs. London, 1959.

The following is based almost entirely on the author's summary of this account of investigations in Assam during the past ten years on the bionomics of *Oligonychus coffeae* (Nietn.), many of the results of which confirmed earlier work [*cf. R.A.E.*, A **17** 291]. The mite, of which all stages are described and the nomenclature reviewed [*cf.* **44** 19], attacks tea and many other plants, including jute (*Corchorus capsularis*), in India and elsewhere, and it is the most widely distributed and probably the most serious pest of tea in north-eastern India. The duration of the life-cycle is influenced by temperature and humidity; development is completed in an average of 9·4–12 days in May and June, but may last as long as 28 days in cold weather. In the laboratory, the maximum survival period for females was 29 days. The males are shorter-lived and usually died within 4–5 days in the field. Females were more abundant than males. Parthenogenetic reproduction occurred under experimental conditions, all the progeny being males. The mites normally attack the upper surface of mature leaves, in which the sap is not flowing freely. In a severe infestation, particularly in dry weather, the lower surfaces and the young leaves are almost equally attacked. The affected leaves turn brown, and may eventually dry up and fall off. The mites live under cover of a web spun as a protection against the weather. They are abundant from March to June, but almost disappear with the monsoon rains, though a second light attack may develop in September or October. During the cold weather, the mites are present in very small numbers on a few old leaves, and are slightly more abundant on those of unpruned tea bushes, bushes on which the tips of the shoots are removed some time after plucking is completed and on young tea than on pruned bushes. With the rise in temperature in spring, the mites multiply rapidly, resulting in subsequent heavy infestations. Various factors affect the incidence and intensity of attack. Pruned bushes properly cleaned out are less attacked than others. Bushes defoliated after pruning and medium pruned tea remain practically unaffected [*cf.* **17** 291; **26** 694]. Prolonged dry weather during the early part of the flushing season normally increases incidence. *O. coffeae* prefers bright sun, and unshaded tea is more heavily attacked than shaded. The mite spreads from bush to bush chiefly by crawling, but is also dispersed by wind and on the bodies of cattle and the clothing of labourers. Adults and larvae of Staphylinids and of the Coccinellids, *Verania vincta* Gorham, *Stethorus* sp., *Jauravia* sp. and *Scymnus* sp. as well as larvae of two species of *Chrysopa* feed on all stages of the mite and often afford considerable control.

Howe (R. W.). **Studies on Beetles of the Family Ptinidae. 15. The Biology of** *Ptinus hirtellus* **Sturm and some Notes on** *P. latro* **F.**—*Ent. mon. Mag.* **92** no. 1110 pp. 369–372, 1 graph, 27 refs. London, 1957. **16. The developmental Period of** *Ptinus clavipes* **Panz. form** *mobilis* **Moore** (= *P. latro* **auct.**).—*Op. cit.* **94** no. 1133 pp. 236–237, 5 refs. 1958. **17. Conclusions and additional Remarks.**—*Bull. ent. Res.* **50** pt. 2 pp. 287–326, 10½ pp. refs. London, 1959.

In the first two of these parts of a series dealing with Ptinids associated with stored products [*cf. R.A.E.*, A **46** 240, etc.], the author describes investigations on the bionomics of *P. clavipes* Panz. (*hirtellus* Sturm), which

is widely distributed but is not regarded as a major pest, and its gynogenetic triploid form, *mobilis* Moore (*P. latro*, auct.) [*cf.* **46** 357; **47** 365].

In the last part, which concludes the series, he discusses and summarises findings on the nomenclature, world distribution, distribution and status in Britain, habitats, rearing, bionomics and natural enemies of the 14 Ptinids studied and on their economic importance and possible spread. The following is based on his summary of the work. The identification of the Ptinids found in storage premises, especially that of species of *Ptinus* and *Mezium*, has frequently been incorrect, and existing descriptions of genera and subgenera are inadequate; there is good correspondence between groupings of species based on adult and on larval characters. The Ptinids considered to be native to Britain are *P. lichenum* Marsham, *P. palliatus* Perris and *P. subpilosus* Sturm, which are not found in storage premises, and *P. fur* (L.) [*cf.* **40** 68; **46** 357], *P. sexpunctatus* Panz. [*cf.* **40** 68] and *Tipnus unicolor* (Pill. & Mitt.) [*cf.* **46** 65], which occur in warehouses. Eight species and a gynogenetic form have been introduced into Britain and have become established, *M. affine* Boield. [*cf.* **46** 64], *Gibbium psylloides* (Czenp.) and *Niptus hololeucus* (Fald.) [*cf.* **40** 202] early in the 19th century, *P. clavipes* and its form *mobilis* later in the 19th century, *P. tectus* Boield. [*cf.* **41** 443], *Trigonogenius globulus* Sol. [*cf.* **40** 202] and *P. pusillus* Sturm [*cf.* **46** 240] about 1900, and *Pseudeurostus hilleri* (Rttr.) [*cf.* **28** 531; **38** 478; **40** 202; **46** 65] about 20 years ago. Only *Ptinus tectus* is a widespread pest in Britain [**38** 477].

Ptinids are mainly scavengers and many feed equally readily on material of plant or animal origin. Since they are especially attracted to moisture and excrement, they may occur in the protected nests of other animals, and the published records of their associations with nests of insects, birds and mammals [*cf.* **31** 110; **42** 43, 124] are summarised in a table. The presence of animal droppings and dead insects enables Ptinids to grow rapidly; wool, hair and feathers, textile fabrics, old wood and various apparently non-nutritive substances are damaged by the larvae, which seem to be able to develop on some of them.

The damage caused by Ptinids is mainly indirect, comprising contamination with frass, silk and fragments of dead insects and the boring of holes in and the spinning of cocoons on containers [*cf.* **41** 444]. The actual loss of weight of produce caused by feeding is small unless the population is very great. A large proportion of the adult Ptinid population of a warehouse inhabits cracks in the floors or walls and spreads from there to the peripheral parts of stacks of produce, where eggs are laid and a superficial infestation occurs. The adults are active chiefly at night. Ptinids usually have three larval instars, but adverse conditions may increase the number [*cf.* **32** 35; **40** 68]. The total development period is long compared with warehouse beetles of other families. Most Ptinids have a normal life-cycle, but some species of *Ptinus* have a facultative larval diapause and an adult dormant period preceding emergence from the cocoon [**40** 68; **46** 65, 240]. The diapause and dormancy enable adults of these species to emerge in the autumn regardless of the weather during the previous season. Adults survive for 6–15 months. At constant temperature, eggs are laid at a steady rate, the number per female varying from under 50 in some species of *Ptinus* to nearly 1,000 in *P. tectus*. The influence of temperature, humidity, food, population density, diapause and dormancy on the rate of increase [*cf.* **41** 311] is discussed. The most rapid increase possible for the British species is a doubling of the population in three weeks by *P. tectus*. It is concluded that this species is unlikely to be superseded as the most important Ptinid of cool temperate areas and that, elsewhere, other Ptinids will not attain the same importance. When the species are grouped according to biological features, the arrangement obtained agrees with the taxonomic relations of the family.

Symmons (P.) & Carnegie (A. J. M.). **Some Factors affecting Breeding and Oviposition of the Red Locust,** *Nomadacris septemfasciata* (**Serv.**).—*Bull. ent. Res.* **50** pt. 2 pp. 333–353, 2 pls., 19 figs., 11 refs. London, 1959.

The following is virtually the authors' summary. Observations were made on *Nomadacris septemfasciata* (Serv.) between October 1957 and February 1958 in an area of grassland, six miles long by one mile wide, marked out by beacons and divided lengthwise by a line of beacons down the centre, in the Rukwa Valley of south-western Tanganyika. One half of the plot had been burnt off completely in the latter part of the dry season; the other half was unburnt and carried in part a four-year accumulation of growth and in part an area of standing grass that had regenerated after a damaging fire during the previous wet season and had then, for the most part, been flooded. Vegetation profiles were made along the whole length of the plot, and rain gauges, soil thermometers and soil tensiometers were installed at regular intervals along the three lines of beacons. Assessments of the population and distribution of adult locusts within the plot were made from Land-Rover [*cf. R.A.E.*, A **46** 301] or on foot in mid-October, mid-December (ten days after the onset of the rains) and early January. A systematic search was made for egg-pods, starting at the end of December, along furrows ploughed down the middle of each of a number of narrow strips mown in the grass in sets near each beacon and sampling equally the burnt and unburnt halves of the plot. The first hoppers were seen on 3rd January, and assessments of hopper populations were carried out four times during January.

The primary object of the work was to study the effect on choice of oviposition site and on incubation success of the type and condition of the grassland (whether burnt during the previous dry season, burnt at an earlier date, or left unburnt) and its possible bearing on control of the species in an outbreak area. Data were also obtained on the conditions of air temperature, soil moisture, soil temperature and rainfall in which eggs are laid and incubated; and the effect of variations in these factors on oviposition and on incubation success was examined. It was observed that, in the hot, dry conditions of mid-October, adult locusts were completely absent from the recently burnt-over ground, and were found almost exclusively in that part of the standing grass that had suffered a wet-season burn. By mid-December, the locusts had spread out from the unburnt into the burnt-over zone where the grass had put out fresh growth, but many were still to be found in the former area, with a concentration along the line of contact with the latter. By early January, the size of the population had been greatly reduced, and it was evenly distributed over the whole plot. The distribution of egg-pods showed that the locusts had laid almost exclusively in the burnt-over zone, about 50 per cent. being found within 0·1 mile of the line of contact with the unburnt zone. The hoppers were likewise almost exclusively confined to the burnt-over zone, and numbers were significantly higher in the $\frac{1}{4}$-mile band next to the contact line than in the band at $\frac{1}{4}$–$\frac{1}{2}$ mile from it. The numbers of hoppers in the unburnt grass were significantly lower than might have been expected from the results of the egg-pod survey, suggesting that survival was lower there than under fresh grass following a dry-season fire. A subsidiary experiment, in which adult locusts were confined in cages placed on the lately burnt-over zone, the early-burnt zone and the unburnt area, suggested that, where there was no choice of oviposition site, the greatest number of surviving egg-pods occurred in the first zone, almost as many in the second and about half as many in the third.

During the incubation period, the soil under the unburnt grass was significantly colder, and tended to be moister, to moisten more slowly and to dry out less rapidly than that which had been burnt over. No significant

correlation was found between incubation success in the burnt-over zone and total rainfall, mean recorded soil temperature or soil moisture.

It is concluded that, since these observations show that ovipositing adults of *N. septemfasciata* exhibit a very significant preference for ground that has been burnt over in the previous dry season, the burning of selected strips should lead to a concentration of oviposition and, consequently, of hoppers, thus making chemical control of the latter easier and cheaper. There was some evidence, also, that when locusts could not move to bare ground, oviposition, egg-pod survival or both were least successful where the grass cover was thickest.

COURSHEE (R. J.). **Drift Spraying for Vegetation Baiting.**—*Bull. ent. Res.* **50** pt. 2 pp. 355–370, 14 figs., 19 refs. London, 1959.

The following is virtually the author's summary. The term drift spraying denotes a method of applying an insecticidal spray whereby it is released at a height above the ground and allowed to drift with the wind while it gradually sinks; if the source of emission is moved in a line across the direction of the wind, insecticide will be deposited at a distance downwind of that line. The method has been used for vegetation baiting, a term meaning the application of stomach poisons to natural vegetation for control of locusts; this may be more economical than the application of contact insecticides to the insect itself [*cf.* next abstract].

Spray particles emitted from a point source have a mean trajectory downwind inclined to the horizontal at an angle of $\tan^{-1}(f/V)$, where f is their terminal velocity and V the wind speed, and they are dispersed by wind eddies to all sides of this mean axis so as to form a conical plume; if the source is moved across the wind, horizontal dispersion normal to the wind tends to cancel out and only the vertical component of the dispersion need be considered. The concentration of spray drops is at a maximum on the plume axis and decreases with distance from it. The spray cloud from such a source thus occupies a wedge-shaped space as it drifts downwind, and it reaches the ground over a band of which the width depends on the height of the source and the degree of dispersion. The point at which the plume axis strikes the ground is determined by its declination and by the height of the source; the density of the spray deposit, the over-all value of which is determined by width of the band sprayed and by the quantity of spray emitted from the source per unit distance travelled across wind, is at a maximum upwind from this point and diminishes more steeply towards the upwind edge of the band than towards the downwind one.

Large drops will fall faster and hence be deposited nearer the line of emission than will small drops, but in practice, in day-time, the effects of dispersion by wind eddy tend to exceed and mask those due to the range of drop size, and it is thus a valid simplification to consider the spray cloud as composed of drops all of one size. The behaviour of heterogeneous sprays is best characterised by the assumption that all drops are of a diameter equal to the surface-volume mean diameter. At moderate wind speeds, the drop diameter used should be of the order of 100μ, and an oil of low vapour pressure is needed if the tendency of such small drops to evaporate before reaching the target is to be overcome.

The angle of dispersion probably depends on the degree of wind turbulence. Experimental measurements of the concentration of drops within a spray plume, relative to that on the axis and at different angular deviations from the latter, enable the fraction within each sector to be known, and suggest that for normal atmospheric conditions, when the lapse rate is adiabatic,

95 per cent. of the spray is contained within $\pm 7°$ of the plume axis in the vertical plane.

The calculated densities of deposits on a horizontal surface at varying distances downwind, related to a source whose height and rate of emission are unity, are shown as graphs for different values of the declination of the plume axis (predictable from the wind speed and drop size) and are compared with experimental measurements. By using these data, the conditions that will afford any desired deposit density can be selected. Since the interest of drift spraying for locust control lies mainly in the deposits on the nearly vertical stems of grass, similar data are given for values of the deposit density on an exposed vertical surface, which can be shown to be n times that on a horizontal one at the same distance downwind, when the latter is expressed as a multiple, n, of the source height.

Sayer (H. J.). **An Ultra-low-volume Spraying Technique for the Control of the Desert Locust,** *Schistocerca gregaria* **(Forsk.).**—*Bull. ent. Res.* **50** pt. 2 pp. 371–386, 2 pls., 6 figs., 9 refs. London, 1959.

The following is substantially the author's summary. Studies of the physical and biological factors involved in the application of concentrated solutions of a persistent insecticide (dieldrin) in non-volatile oil in the form of a fine spray to the low-density vegetation typical of the breeding areas of *Schistocerca gregaria* (Forsk.) [*cf.* preceding abstract] led to a technique of control of the locust hoppers with a dosage as low as about $\frac{1}{3}$ pint 20 per cent. dieldrin solution per acre. A simple device for producing such a spray was designed to work off the exhaust system of a light four-wheel-drive motor vehicle. Successful control of hoppers was obtained under a wide variety of weather conditions in both desert and bush typical of locust breeding areas, using " target " and " barrier " spraying techniques. Both techniques involve the spraying of vegetation which it is judged will be subsequently eaten by the hoppers, but target spraying is done on or near a known hopper band, whereas barrier spraying is done, not necessarily in sight of hoppers, across an area known to be highly infested. Examples of such successful attacks are described from the Eritrean coast, Tripolitania and Ethiopia. The methods can replace the well-established technique of poison-baiting individual bands and have the additional advantage of producing highly persistent toxic swathes that can be exploited by the barrier technique for treating locust egg-fields and for creating widely spaced barriers for the control of extensive infestations.

Clarke (K. U.) & Sardesai (J. B.). **An Analysis of the Effects of Temperature upon the Growth and Reproduction of** *Dysdercus fasciatus* **Sign. (Hemiptera, Pyrrhocoridae). I.—The intrinsic Rate of Increase.**—*Bull. ent. Res.* **50** pt. 2 pp. 387–405, 1 pl., 8 graphs, 5 refs. London, 1959.

The following is virtually the authors' summary. In laboratory studies of *Dysdercus fasciatus* Sign., populations were exposed to constant temperatures of 15, 20, 25, 30, 35 and 40°C. [59, 68, 77, 86, 95 and 104°F.] and a relative humidity of 60 per cent., and to 28°C. [82·4°F.] and 70 per cent. relative humidity. After hatching, the insects were supplied with cotton seed as food and water to drink. Development of eggs was incomplete below 25°C., of nymphs below 20°C., and of both above 30°C. To allow comparison of

growth and rate of reproduction at temperatures outside the embryonic range, this stage was ignored in calculating values of the intrinsic rate of increase r [*cf. R.A.E.*, A **38** 91], and the mortality rate and length of life were measured from the time of hatching, the eggs being incubated under optimum conditions (those at 28°C.) and the freshly hatched nymphs then moved to the appropriate temperature. The value of r was found to increase with increasing temperatures up to 30°C., and to do so more rapidly between 25 and 28°C. than between 20 and 25°C. The age-schedule of deaths for populations living at 28°C. showed a distribution of deaths that was almost ideal, in that their highest frequency did not occur until the reproductive period was advanced. The principal deviation from this was due to the high mortality in the first instar. At 20°C., the death rate approached constancy throughout the life-span of the population. The interval between generations decreased with increasing temperature, the rate of decrease being approximately 4·6 days per 1°C. [1·8°F.] rise in temperature.

Further analysis of r was made by considering separately the growth and reproductive characteristics of the insect, and the effect of temperature upon them. The rate of post-embryonic growth, as measured by live weight, increased with temperature, within the range of 20–30°C. Growth did not proceed beyond the third instar at 15°C., or beyond the fifth instar at 35°C. The principal cause of the increase in growth rate was the decrease and eventual disappearance of the periods between initial ecdysis and start of growth, and between the end of growth and final ecdysis, the rate at which growth actually took place differing but slightly. The size of the insect just after the final ecdysis had an important effect on r because the number of eggs laid by small females (mean weight 68·7 mg.) was only about half that of large ones (mean weight 100·2 mg.). Any decrease in size observed with increasing temperature was slight compared with that produced by restricting access to drinking water. Copulation and oviposition occurred in adults maintained at any of the temperatures except 15 and 40°C. The percentage of females that laid eggs differed according to the temperature, the highest recorded being 90 per cent. at 28°C. and the lowest 30 per cent. at 20°C. The total time spent in copulation also varied with temperature, being greatest (26·3 days) at 20°C. The change of weight of the female after moulting largely represented growth of the ovaries; at 15°C. this is slow and not completed before the female dies; at 40°C. the ovaries do not mature; at other temperatures tested (20–35°C.) growth is fairly rapid, the ovary being fully grown in about four days. The fertile female lays eggs in batches, the maximum observed being six batches, at approximately three-day intervals. A few females survived the laying of the sixth batch of eggs by a period longer than their interoviposition period. At 28°C., the preoviposition period and the time spent in copulation were less, more egg-batches, and hence more eggs, were produced and a higher proportion of females mated, than at any other temperature. In the unmated female, the average life was twice that of the mated one, the preoviposition period was the same, the interoviposition period approximately three times as long, the egg-batches half as numerous, and the number of eggs per batch nearly the same. All fertile females were observed to lay eggs, but only 20 per cent. of the unmated ones did so. At 35°C., mated females produced one or two batches of eggs; unmated ones produced none, and although the ovary matured normally up to the fourth day, the yolk was subsequently reabsorbed, this process being complete by the 14th day.

These studies indicated that in *D. fasciatus* the decrease in the value of r with decreasing temperature is caused by a rise in pre-reproductive mortality and a fall in reproductive capacity, as well as by the increase of the generation length, which other workers have found to be of predominating importance in the case of other insects.

Burges (H. D.). **Studies on the Dermestid Beetle,** *Trogoderma granarium* **Everts. II.—The Occurrence of Diapause Larvae at a constant Temperature, and their Behaviour.**—*Bull. ent. Res.*. **50** pt. 2 pp. 407–422, 5 figs., 4 refs. London, 1959.

The following is largely the author's summary of this second paper of a series [*cf. R.A.E.*, A **47** 235]. The development of *Trogoderma granarium* Everts and its cycle of movement between food and hiding places was studied at 30°C. [86°F.], and the results were correlated with observations made at maltings, its chief habitat in Britain [*cf.* **44** 85]. In populations kept at 30°C., many larvae became inactive, tended to remain in crevices, and delayed pupation, whereas the remainder spent most of their time on the food and completed development rapidly. The former, which are termed diapause larvae, left the food in the fourth or a later instar in search of suitable hiding places, and disturbing the food stimulated them to leave it a little earlier. Diapause larvae moulted occasionally, and at long and irregular intervals they emerged from their hiding places, presumably to replenish their food reserves by feeding, after which some pupated and the rest hid themselves again. The hidden diapause larvae persist for a long time; in cultures, 16 per cent. were still present after four years. Apparently, as the food stored in the fat-body is depleted, they become readier to emerge from the crevices to feed. Replacing stale food by fresh caused some diapause larvae to emerge, but the effect of disturbing the larvae was variable. After feeding, some of the diapause larvae completed development, and the resulting adults reproduced, presumably giving rise to both quick-developing and diapause larvae among their offspring. When denied a hiding place, the diapause larvae remained inactive in the food without increasing their rate of pupation. However, they fed more and gave rise to heavier beetles, an effect also obtained by regularly providing fresh food. Larvae found in crevices in the fabric of maltings and in blocks of wood containing artificial crevices left on or near the malt were almost all in the fourth or later instars, and the proportion of diapause larvae varied from at least 21 to at least 69 per cent. It is concluded that when a store is filled with malt, some diapause larvae remain in the fabric of the building and others emerge and feed. After feeding, some larvae re-enter crevices and others complete development and reproduce. The offspring contain some diapause larvae, which accumulate in the crevices and on the walls just below the malt surface. After the malt is removed, diapause larvae may persist in empty stores for several years, since they can restore their food reserves by occasionally feeding on grain residues.

Simmons (S. W.). Ed. **DDT. The Insecticide Dichlorodiphenyltrichloroethane and its Significance. Das Insektizid Dichlordiphenyltrichloräthan und seine Bedeutung. Vol. II. Human and Veterinary Medicine.**—*Lehrb. Monogr. Geb. exakt. Wiss., chem. Reihe* **10** $9\frac{1}{2} \times 6\frac{3}{4}$ ins., 570 pp., illus., many refs. Basle & Stuttgart, Birkhäuser Verlag, 1959. Price *Sw. Fr.* or *DM.* 66.00.

This second of a proposed series of three volumes on the development and uses of DDT, under the general editorship of P. Müller [*cf. R.A.E.*, A **44** 306], is entirely in English and comprises three critical reviews.

In **Pharmacology and Toxicology of DDT** (pp. 9–247, 15 figs., 685 refs.), W. J. Hayes jr. reviews data on the clinical, pathological and physiological effects of DDT in vertebrates and on the dosage-mortality relationships established, on its metabolism to other compounds in them, on the toxicity

of DDT to man (as observed in intentional experimental exposure, in accidental poisoning and in the course of ordinary use), on the hazards to which workers are exposed and the dangers arising from deposits in animal and vegetable products and in water and means of reducing them, on protection from excessive exposure, and on hazards to domestic mammals and birds, to silkworms [*Bombyx mori* (L.)] and bees and to wildlife. Reference is made to a few attempts to use DDT for the control of undesirable vertebrates.

The two other reviews are concerned with the use of DDT for the control of pests and arthropod-borne diseases of man and animals and are noticed elsewhere [B **47** 145].

Davis (G. R. F.). **Growth and Feeding Behavior of Larvae of** *Ctenicera aeripennis destructor* **(Brown) (Coleoptera: Elateridae). III. Effects of Seeds of Crested Wheatgrass, Bromegrass, and Rape.**—*Ann. ent. Soc. Amer.* **51** no. 3 pp. 248–250, 6 refs. Washington, D.C., 1958.

In this third part of a series [*cf. R.A.E.*, A **47** 131], an account is given of tests in Canada in which larvae of *Ctenicera aeripennis destructor* (Brown) were reared for 30 weeks on seeds of crested wheatgrass [*Agropyrum cristatum*], bromegrass [*Bromus*] and rape. The following is based on the author's summary of the results. Rape seed was attractive when no choice of food was available, but less so when combined with the two other foods. Medium-sized larvae gained more weight and survived in greater numbers on rape seed than on the other foods, which caused a loss in weight. Large larvae maintained their original weight, except on *A. cristatum*, and survived in greater numbers on *Bromus* or the mixed diet or without food than with *A. cristatum* or rape seed. The data indicate a nutritional difference between larvae of the two sizes.

Pathak (M. D.) & Painter (R. H.). **Differential Amounts of Material taken up by four Biotypes of Corn Leaf Aphids from resistant and susceptible Sorghums.**—*Ann. ent. Soc. Amer.* **51** no. 3 pp. 250–254, 1 fig., 3 refs. Washington, D.C., 1958.

A biological race of *Aphis* (*Rhopalosiphum*) *maidis* Fitch, termed biotype KS-2, was found to have a greater survival capacity and higher fecundity on sorghums resistant to this aphid in Kansas than the remaining population, termed biotype KS-1 [*cf. R.A.E.*, A **45** 352]. At least two additional biotypes, termed KS-3 and KS-4, details of which are to be published elsewhere, have since been isolated, and an account is given in this paper of investigations on the amounts of plant liquids taken in by aphids of the four biotypes on resistant and susceptible plants. The following is based on the authors' summary of the results.

Aphids of all the biotypes gained significantly more weight on susceptible than on resistant plants, and also showed reduced fecundity on resistant ones. Weight lost on resistant plants was significantly less than the loss when the aphids were kept without access to food. Biotype KS-2 differed from others in its ability to take significantly more material from the resistant plants, on which it also had a greater fecundity than any of the others. The aphids, after being kept overnight without food, took some material from resistant plants in their first three hours of feeding, but lost weight later. In contrast, the fecundity of the biotypes and the amount of plant material taken were not

positively related on susceptible plants, where biotypes taking in the most material reproduced the least.

HACKEROTT (H. L.), HARVEY (T. L.), SORENSEN (E. L.) & PAINTER (R. H.). **Varietal Differences in Survival of Alfalfa Seedlings infested with Spotted Alfalfa Aphids.**—*Agron. J.* **50** no. 3 pp. 139–141, 5 refs. Washington, D.C., 1958.

The following is substantially the authors' summary. When seedlings of 31 varieties and strains of lucerne were infested with *Therioaphis maculata* (Buckt.) in the greenhouse at average temperatures of about 75°F., they exhibited a wide range of survival, Lahontan [*cf. R.A.E.*, A **45** 260], Nemastan and C104 being the most resistant; about 70 per cent. of the varieties tested survived at a low rate. Resistant plants can apparently be isolated from most of the varieties tested [*cf. loc. cit.*], as indicated by the high rate of survival of the polycross progenies of these selected plants. In general, lucernes derived from Turkestan appeared to include a higher proportion of resistant plants than the other varieties tested, with the exception of the African ones.

GIBSON (W. W.) & PAINTER (R. H.). **The Occurrence of Wheat Curl Mites, *Aceria tulipae* (K.), (Eriophyidae), a Vector of Wheat Streak Mosaic on Winter Wheat Seedlings grown from infested Kernels.**—*Trans. Kans. Acad. Sci.* **59** no. 4 pp. 492–494, 2 refs. Topeka, Kans., 1956.

The following is substantially the authors' summary. When wheat kernels in the dough and newly ripened stages, obtained in Kansas from artificially shattered heads infested by *Aceria tulipae* (Keifer), were sown and allowed to sprout quickly in field cages, many of the seedlings were found to be infested by the mite, whereas none of those from seed that had been fumigated with naphthalene were infested. This suggests that shattering of infested grain, followed by rapid sprouting, such as may occur in the field after hail or mechanical injury, may result in the direct movement of mites from the kernels to the resulting seedlings. As the kernels have been found able to harbour the virus causing wheat streak mosaic, which is transmitted by *A. tulipae*, such movement might result in fresh transmission of the disease.

WOLFENBARGER (D. O.). **Pyriform Scale Control on Avocados.**—*Florida Ent.* **41** no. 1 pp. 1–4, 2 graphs, 2 refs. Gainesville, Fla., 1958.

The following is virtually the author's summary. Parathion and malathion sprays were used over a period of two and a half years in experimental plots for control of *Pulvinaria* (*Protopulvinaria*) *pyriformis* (Ckll.) on avocados in Florida. Leaf samples were collected from the experimental trees at irregular intervals following the spray applications. Summarisation of the data showed that 1 lb. 15 per cent. wettable parathion per 100 U.S. gal. was more effective than 2, 4 or 6 lb. 25 per cent. wettable malathion or 1 lb. technical malathion in emulsion form. Scale infestations were significantly reduced by all treatments.

Harris jr. (E. D.). **Studies on Corn Earworm Control in the Everglades.** —*Florida Ent.* **41** no. 1 pp. 17–22, 1 ref. Gainesville, Fla., 1958.

Details are given of tests in which all the insecticide treatments recommended or used and some of the newer insecticides were compared for the control of *Heliothis zea* (Boddie) on sweet maize in the Everglades district of Florida. It was found that wettable DDT, which has not been recommended, but is commonly used, was as effective as an emulsion concentrate in sprays applied at equal rates, 2 lb. active ingredient per acre in either form giving 95–99 per cent. uninfested ears when applications were made at intervals of 1–2 days during the silking period. Parathion was about as effective as DDT. The addition of toxaphene did not improve the control given by parathion and decreased that by DDT in emulsion sprays. Endrin, Sevin [1-naphthyl N-methylcarbamate], Thiodan [6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3-oxide] and Guthion [O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate] were about as effective as DDT when used at high rates of application in sprays, but in view of their cost offer no advantage.

Rohwer (G. G.). **The Mediterranean Fruit Fly in Florida—Past, Present, and Future.**—*Florida Ent.* **41** no. 1 pp. 23–25. Gainesville, Fla., 1958.

The author compares the recent campaign against the Mediterranean fruit-fly [*Ceratitis capitata* (Wied.)] in Florida [*cf. R.A.E.*, A **45** 259, etc.] with the earlier one carried out in 1929–30 [*cf.* **19** 433, etc.] and states that, at the time of writing, no examples had been found there since 7th August 1957, when a single adult was recovered in Hillsborough County, 37 days after the last preceding capture. This was the longest interval between captures since the campaign began.

Harris jr. (E. D.). **Factors affecting the Results of Corn Earworm Control Studies.**—*Florida Ent.* **41** no. 2 pp. 51–60, 4 graphs, 11 refs. Gainesville, Fla., 1958.

The following is substantially the author's summary. Comparisons of two methods of evaluating the injury to sweet maize caused by *Heliothis zea* (Boddie) in Florida indicated that an injury index is superior for variety trials and the percentage of uninfested ears for studies of chemical control. Increasing the number of ears examined per plot (a 100-ft. row) from 25 to 50 and 100 greatly increased the information obtained from control experiments, but unequal stands affected the results. When DDT sprays were applied to run-off, the volume per acre was much less for wettable-powder sprays than for emulsions, though the concentration of DDT was the same.

King (J. R.) & Thompson (W. L.). **Fruit Piercing Moth, *Gonodonta nutrix* (Cramer), attacks Oranges in Florida.**—*Florida Ent.* **41** no. 2 pp. 61–65, 4 figs., 4 refs. Gainesville, Fla., 1958.

Oranges with holes through the peel, received from Fort Pierce, Florida, in July 1956, were found to have been pierced by adults of *Gonodonta nutrix* (Cram.), which had previously been recorded as causing such damage only in Cuba. The larvae of this Noctuid develop on *Annona glabra*, which is common on the banks of canals and rivers, and the adults attack the oranges at night, apparently sheltering close to the water during the day. Observations on the seasonal development of the moth are briefly described.

Ebeling (W.) & Wagner (R. E.). **Two newer Weapons for Drywood Termite Control and Prevention.**—*Pest Control* **27** no. 2 pp. 40, 42, 44–46, 2 figs., 2 refs. Painesville, Ohio, 1959.

Dry-wood termites [*Kalotermes minor* Hagen] are now about as important as subterranean termites as pests of structural timbers in southern California. They are usually found infesting attics or window frames, but sometimes attack the timber substructure of a house. The authors describe two methods of treatment that are more rapid, cheap and persistent than drilling into the galleries and injecting an insecticidal dust or liquid fumigant, which is the usual method of control.

In the first, a thick layer of an emulsified solution of 10 per cent. pentachlorophenol in light oil is brushed over the surface of the infested wood. As the emulsion breaks, the oil readily penetrates through the wood to the galleries, which tend to be formed as near the surface as possible; penetration is particularly good at junctions, where a heavy deposit will penetrate up to 2 ft. along the grain of the wood. Infestation is indicated by the dropping of piles of faecal pellets, and if this continues, a second application should be made to areas that have been missed or inadequately treated; no colony was found to survive in 19 structures treated twice by this method.

The incidence of infestation is so high that reinfestation within a year of treatment is common, and a method of preventing this was based on the observation that certain inert dusts, commonly used as diluents, are more effective against the termites than existing dust formulations of insecticides and do not diminish in effect from exposure to air and high temperature, as they kill by physical means, absorbing the protective wax layer from the bodies of the termites and thus exposing them to desiccation. Certain sorptive clays were found to be among the best, and one proved effective when blown into attics or under houses at the rate of 5 lb. per 1,000 sq. ft. floor area. In comparative tests in which three blocks of wood were hung at various points in an attic before treatment and subsequently caged with ten alates or fully grown nymphs, no feeding occurred and the periods before knockdown and kill of alates were about 70 per cent. of those for nymphs. Silica aerogels, prepared by the reaction of sodium silicate with sulphuric acid, followed by drying and grinding to form amorphous, sorptive and extremely small particles, subsequently proved more effective than clays, particularly when they were coated with small proportions of certain inorganic compounds that gave them a positive charge and increased their deposition properties, regardless of the humidity of the atmosphere. Tests with coated silica aerogels applied at 1 lb. per 1,000 sq. ft. showed that these caused more rapid knockdown and kill than did 6·4 lb. clay or 2 lb. chlordane one day after treatment; at 2 lb., they were much more rapid than was 4 lb. chlordane both one and 35 days after treatment. They are also reported to have proved effective against cockroaches and other household pests, including colonising bees and wasps, and against the two-spotted mite [*Tetranychus telarius* (L.)] on roses.

da Fonseca (J. P.). **Três novas espécies de coccideos do Brasil, sôbre cafeeiro (Homoptera-Coccidae).** [Three new Species of Coccids on Coffee in Brazil.]—*Arq. Inst. biol.* **24** (1957) pp. 123–135, 1 pl., 14 figs. São Paulo, 1958. (With a Summary in English.)

Descriptions are given of the adult females of *Cerococcus catenarius*, *Coccus brasiliensis* and *C.* (*Lecanium*) *lizeri*, spp. n., all from coffee in São Paulo and the first also in Paraná. *Cerococcus catenarius* infests the stems and

branches and is also recorded from *Cajanus cajan* (*indicus*), *Coccus brasiliensis* occurs on the branches, stems and roots and closely resembles *C. africanus* (Newst.), material of which from coffee in Kenya was compared with it, and *C. lizeri* was found on the leaves, generally along the margins on the lower surfaces. The male of *Cerococcus catenarius* is unknown, but the scale formed by it is briefly described.

Puzzi (D.) & Orlando (A.). **Ensáios para seleção de substâncias, sob forma líquida, como atraentes para a mosca do Mediterrâneo**—*Ceratitis capitata* (**Wied.**). [Screening Tests of Chemicals for Liquid Bait in Traps as Attractants for *C. capitata*.]—*Arq. Inst. biol.* **24** (1957) pp. 137–149, 7 refs. São Paulo, 1958. **Estudos de substâncias atrativas à mosca do Mediterrâneo**—*Ceratitis capitata* (**Wied.**) **na forma de iscas sêcas, com o emprêgo de uma nova técnica.** [Studies on attractive Substances employed as dry Baits for *C. capitata*, with a new Technique.]—*T. c.* pp. 151–161, 2 pls., 5 refs. (With Summaries in English.)

Details are given in these two papers of experiments in São Paulo showing that a solution of 5–7·5 per cent. brown sugar as a liquid bait and certain protein hydrolysates in dry baits exposed in modified petri dishes are effective attractants for *Ceratitis capitata* (Wied.) [*cf. R.A.E.*, A **47** 72, 95].

da Fonseca (J. P.). **Uma nova espécie de** *Diorymerellus* (**Col. Curculionidae Barininae**) **prejudicial ás orquideas.** [A new Species of *Diorymerellus* injurious to Orchids.]—*Arq. Inst. biol.* **24** (1957) pp. 243–246, 2 figs., 5 refs. São Paulo, 1958. (With a Summary in English.)

Diorymerellus vigintiestriatus, sp. n., is described from adults of both sexes taken on orchids, principally species of *Cattleya* and *Laelia*, in São Paulo. The larvae of this weevil feed in the flowers, spoiling them completely.

Sauer (H. F. G.) & Lepage (H. S.). **O novo sistêmico RP-7175 no combate ao pulgão do algodoeiro.** [The new Systemic RP-7175 in the Control of the Cotton Aphid.]—*Biológico* **24** no. 1 pp. 1–6, 6 refs. São Paulo, 1958.

In a plot test in São Paulo in 1956–57, endothion (2-(O,O-dimethyl phosphorothiolomethyl)-5-methoxy-4-pyrone), referred to as RP-7175, was compared with two other systemic insecticides, Metasystox (dimethyl 2-(ethylthio)ethyl phosphorothioate [methyl-demeton]) and schradan, in low-volume emulsion sprays for the control of *Aphis gossypii* Glov. on cotton. Endothion was used at 250 and 500 cc., methyl-demeton at 400 cc. and schradan at 1,100 cc. actual toxicant per alqueire (24,200 sq. m.). The cotton was sown late, on 20th December, and the sprays were applied a week later, when most of the plants were only in the cotyledon stage but infestation was already heavy, and again on 18th January, when the aphid population had developed rapidly as a result of warm dry weather. Counts of aphids on sample leaves were made five times between 4th January and 15th February, after which the infestation declined. The results showed that all treatments were highly effective, with no significant differences between them. The reductions in population, as compared with no treatment, were 97–98, 93–97 and 90–93 per cent. 8, 15 and 22 days, respectively, after the first application and almost 100 per cent. after the second, although heavy rain fell 4–5 hours after it, showing that the materials were rapidly absorbed. The infestation was the heaviest ever recorded, reaching nearly 320 aphids per leaf on

untreated plants on 18th January, and investigations showed that it reduced plant growth by 38–44 per cent., boll production by 78–80 per cent. and the yield by 60–65 per cent.

Puzzi (D.) & Orlando (A.). **Experiência de campo para o combate das "moscas das frutas"—*Ceratitis capitata* (Wied.) e *Anastrepha mombinpraeoptans* Seín—realizada no ano de 1957.** [Field Experiment on the Control of Fruit-flies, *C. capitata* and *A. mombinpraeoptans*, carried out in the Year 1957.]—*Biológico* **24** no. 1 pp. 9–12, 1 graph, 6 refs. São Paulo, 1958.

Details are given of field tests in 1957 showing that 0·1 per cent. dieldrin, 0·02 per cent. parathion and 0·2 per cent. malathion, with 5 per cent. molasses, were moderately effective in bait-sprays against *Ceratitis capitata* (Wied.) and *Anastrepha mombinpraeoptans* Seín in a small peach orchard in São Paulo [*cf. R.A.E.*, A **47** 72]. The parathion spray was much more effective in a large *Citrus* planting.

da Fonseca (J. P.). **O *Cerococcus* do cafeeiro.** [The Coffee *Cerococcus*.]—*Biológico* **24** no. 2 pp. 23–25, 1 fig. São Paulo, 1958.

Cerococcus catenarius Fonseca [*cf. R.A.E.*, A **47** 379] was found infesting coffee in São Paulo in July 1954, having spread to it evidently from indigenous plants. The scales occur in rows along the stems and branches causing die-back, and infestation is usually heavy. There is only one generation a year, and the crawlers issue from the parent scale through an orifice in the posterior. The best method of control is to apply a 1 per cent. oil emulsion with soap in November–February or even March, when the crawlers appear; this causes asphyxiation and blocks the orifice through which the young Coccids emerge. Three applications at intervals of 15–20 days are recommended.

Falanghe (O.). **O combate às pragas do trigo proporciona melhores colheitas.** [The Control of Pests of Wheat gives better Yields.]—*Biológico* **24** no. 3 pp. 42–45, 10 refs. São Paulo, 1958.

Wheat is being increasingly grown in São Paulo. Little attention has been paid to the pests attacking it, since it is grown in the cold season (April–August), which restricts their development, but severe local attacks have nevertheless occurred. The pests observed include the larvae of *Laphygma frugiperda* (J.E.Smith), *Mocis repanda* (F.), *Pseudaletia* (*Cirphis*) *unipuncta* (Haw.) and *Elasmopalpus lignosellus* (Zell.), an aphid (*Aphis* (*Rhopalosiphum*) *maidis* Fitch), Cicadellids and other plant bugs, thrips and an unidentified fly that damages the ears. An experiment to estimate the effect of control on yield was carried out in 1957. Wheat was sown at the end of March and treated on 20th May and 5th June with a dust of 20 per cent. toxaphene and 0·4 per cent. parathion at 11·7 lb. per acre, the same followed on the same day by a low-volume spray of 0·25 per cent. Metasystox [dimethyl 2-(ethylthio)ethyl phosphorothioate (methyl-demeton)], or the spray alone. *E. lignosellus* became evident in the early stages of growth, Cicadellids, bugs and thrips later, and the fly at flowering time; aphids were unimportant. All treatments improved the appearance of the plants and

significantly increased the yield, the combined treatment with dust and spray doing so the most, though it was not significantly superior to the dust alone; the yield was more than doubled by both these treatments.

Fadígas jr. (M.), Giannotti (O.) & Almeida (P. R.). **Experimentos de pulverizações com inseticidas sistêmicos em baixo volume para o contrôle de algumas pragas iniciais do algodoeiro.** [Experiments with Systemic Insecticides in low-volume Sprays against early Pests of Cotton.]—*Biológico* **24** no. 5 pp. 75–79, 2 refs. São Paulo, 1958.

The experiments described were carried out in 1957–58 against *Aphis gossypii* Glov., *Tetranychus telarius* (L.) and *Hemitarsonemus latus* (Banks) on cotton in São Paulo, and the insecticides tested, in low-volume sprays, were Metasystox (dimethyl 2-(ethylthio)ethyl phosphorothioate [methyl-demeton]) at 109 g. (from an emulsion concentrate), endothion (2-(O,O-dimethyl phosphorothiolomethyl)-5-methoxy-4-pyrone) at 170 g. (from a wettable powder or emulsion concentrate), endrin at 400 g. with methyl-demeton at 170 g., and an alcohol extract of *Picrasma* spp. at 800 ml. per alqueire [24,200 sq. m.]. The cotton was sown on 31st October and sprayed twice, on 31st December and 10th February. Observations on the incidence of *A. gossypii* and *H. latus* and on plant growth were made at intervals; *T. telarius* was unimportant. All treatments but *Picrasma* extract gave significant control of *A. gossypii*, the mixture of endrin and methyl-demeton being the best. The latter also gave much the greatest reduction in leaves damaged by *H. latus*, the only other treatment significantly reducing this being wettable endothion, and the greatest increase in fruiting (over 100 per cent.). Comparison of the results indicated that infestation by *H. latus*, which was heavy, resulted in 35–40 per cent. loss of squares and bolls.

Nirula (K. K.). **Investigations on the Pests of Coconut Palm. Part III. *Nephantis serinopa* Meyrick. Control.**—*Indian Cocon. J.* **9** no. 3 pp. 174–199, 3 graphs, 31 refs. Ernakulam, 1956.

This further part of a paper forming part of a series [*R.A.E.*, A **45** 337] contains information on the control of *Nephantis serinopa* Meyr. on coconut in southern India, some of which has already been noticed [*cf.* **43** 231]. In a review of attempts at control by the liberation of parasites, including notes on laboratory rearing and the effectiveness of each species as a control agent, it is stated that intensive releases of *Perisierola nephantidis* Mues., *Trichospilus pupivora* Ferrière, *Elasmus nephantidis* Rohw., and *Bracon* (*Microbracon*) *brevicornis* Wesm. in eastern Madras during 1947–49 considerably reduced a severe outbreak that began in 1947, though *T. pupivora* was recovered only in small numbers and during the cooler months, and this species and *P. nephantidis* gave satisfactory control in another area when liberated between July 1945 and August 1949. Following the liberation of *T. pupivora* between December 1950 and May 1951 in a heavily infested district in Kerala where only small numbers of the other three species were present, control was effected and maintained until March 1951, but recoveries of *T. pupivora* were small in April and May and infestation had again become severe. Early attempts at control by the removal and destruction of infested fronds proved unsuccessful [*cf.* **14** 480].

In investigations on control by insecticides in Kerala [*cf.* **43** 231], wettable-powder sprays of DDT at 0·1–0·4 per cent., BHC at 0·05–0·2 per cent. and toxaphene at 0·05–0·2 per cent. applied to infested fronds were all fairly

effective, but DDD and lead arsenate, both at 0·1 and 0·2 per cent. did not give more than 50 per cent. mortality. DDT and BHC at 0·1 and 0·2 per cent. were tested on young artificially-infested palms in the field. DDT gave 70 and 79 per cent. mortality at the two strengths, respectively, and BHC 75 and 78 per cent. Except in one replicate with 0·1 per cent. DDT, in which 10 per cent. of the larvae were feeding normally seven days after the application, all the larvae present were affected by the treatments. BHC acted more quickly than DDT, and there was 16 per cent. mortality in the controls. The persistence of these materials was tested in 1951 and 1952 during the months of maximum rainfall. Leaflets from fronds of young palms sprayed with 0·2 per cent. DDT in June and August 1951 and September 1952 remained toxic to fourth-instar larvae for over two months, during which, in 1951, rainfall exceeded 18 in., but leaves sprayed in August 1952 lost their toxicity in 20–30 days, probably as a result of the continuous rain. BHC lost all toxicity after a maximum of 20 days and, in general, mortality fell to less than 40 per cent. in a week. An attempt to control a heavy infestation of third- and fourth-instar larvae by means of a spray of 0·1 per cent. BHC applied in the third week of February 1952 at a rate of 1 gal. per two mature palms was unsuccessful, despite high initial mortality, since the absence of a toxic residue permitted numbers to build up from adults emerging on the sprayed and control trees, and similar results were obtained in another district. In 1951 and 1952, some thousands of palms in several plantations were sprayed with DDT at 0·2 per cent. if infested or at 0·1 per cent. as a protective measure if not, the rate of application being 1 gal. spray per 2–3 mature palms; in heavily infested coastal and backwater areas, three applications were made in January, April and after the monsoon in September or October. Good control resulted.

Nirula (K. K.). **Investigations on the Pests of Coconut Palm. Part IV.** *Rhynchophorus ferrugineus* **F.**—*Indian Cocon. J.* **9** no. 4 pp. 229–247; **10** no. 1 pp. 28–44, 1 pl., 5 figs., 36 refs. Ernakulam, 1956.

This fourth part of a series [*cf.* preceding abstract] contains information, based on the literature and on work in Kerala, on the bionomics and control of *Rhynchophorus ferrugineus* (Ol.) on coconut, with descriptions of all stages. Extensive planting of coconut in India has greatly increased the area available to this weevil, which chiefly attacks young plantations, and it was recently estimated to infest 0·5 per cent. of the palms in Kerala. It also attacks other palms, and was observed breeding in *Agave americana* in south Travancore. In young coconut plantations, especially those near forests, every palm over wide areas may be affected. Infestation is restricted to the crown on old palms, but in palms up to five years of age the trunk and bole may also be attacked, though infestation of the bole is confined to seedlings. The growing tip of young palms is occasionally destroyed and the tree killed outright, but usually successive attacks occur and infestation is masked until the tree is injured beyond recovery; even one larva is sometimes able to destroy a palm.

The eggs are deposited singly in holes made in the soft tissues of the palm by the female or among loose, decaying matter in the trunk, and experiments indicated that females can oviposit in sound palms up to seven years old. The larvae enter young palms at any point, but are generally confined to the upper parts of older ones, which they usually enter at the site of injuries, where the soft central tissues are exposed. They also enter through cut petioles, and larvae that hatched from eggs laid at the cut end of petioles 2 ft. in length reached the crown in about 20 days. Of a large number of infested palms examined, 5 per cent. of those up to seven years old, 35 per

cent. of those 7–15 years old, and 55 per cent. of older ones were also attacked by the rhinoceros beetle [*Oryctes rhinoceros* (L.)] [*cf. R.A.E.*, A **9** 297; **43** 229]; it was not known which attacked the palms first. In the laboratory, the egg, larval, and pupal stages lasted 2–5, 35–78 and 12–21 days, respectively. The larvae tunnelling in the palm fed only on soft, succulent tissues. When fully grown they constructed cocoons, in which they pupated two days later, and the adults remained in the cocoons for 4–17 days before emerging. The adults feed on the sap of the palm at suitable sites and in the laboratory survived for only five days without food; rotting palm tissues were more favourable as a food medium than sound ones. Pairing occurred frequently throughout the oviposition period, which lasted 25–63 days, but females that paired only once oviposited normally and most of their eggs hatched. There was a preoviposition period of 2–11 days. The total number of eggs laid per female varied from 76 to 355 and the percentage that hatched from 58 to 100. The adults survived for two or three months, and males were more abundant than females, the sex ratio being 1·32 : 1. No insect parasites were observed, but the pupae and adults in the cocoons were often attacked, especially during the dry season, by an undetermined ectoparasitic mite, in consequence of which the pupae usually died and the survival period of the adults was considerably reduced.

In laboratory tests in which adults were confined in jars containing pieces of peeled coconut petiole that had been immersed for one minute in insecticides, all at a concentration of 1 per cent., a miscible preparation of piperonyl butoxide with pyrethrins (10 : 1) (Pyrocone-E) gave an average mortality of 92 per cent. in seven days, and the remaining weevils were paralysed; 28–86 per cent. of the weevils became paralysed within 24 hours and those that appeared normal did not feed, mate or oviposit. Chlordane in emulsion form caused 50 per cent. knockdown in 12 hours and an average mortality of about 82 per cent. in seven days, the remaining weevils being paralysed. Wettable BHC caused rapid knockdown, but permitted some recovery and feeding; mortality after seven days averaged about 68 per cent. and in one trial 15 per cent. of the weevils were unaffected. Wettable toxaphene and wettable DDT caused relatively little mortality, but prevented oviposition. A similar order of toxicity was shown in tests in which 1 per cent. sprays were applied to larvae feeding in chopped pieces of coconut crown, the percentage mortalities averaging 96, 85, 83, 71 and 16 for Pyrocone-E, chlordane, BHC, toxaphene and DDT, respectively. When the insecticides were poured into cavities made in the stems of screw pines [*Pandanus*] or coconut crowns by larvae previously placed on them, only Pyrocone-E and chlordane gave more than 50 per cent. mortality in a week; in screw pine both gave complete kill, but in coconut the respective mortalities were 90–100 and 60–80 per cent. Mortality among adults and larvae that had been in contact for four hours with food material sprayed with Pyrocone-E amounted to 66 and 62 per cent., respectively, in a week; contact for longer periods gave progressively greater mortality, which, after contact for 24 hours reached 89 per cent. among adults and 93 per cent. among larvae, and there was no recovery among adults initially knocked down. When sprays of BHC, chlordane and Pyrocone-E were injected at a rate of 1,000 cc. per tree into palms, 10–15 years of age, that were each artificially infested with ten larvae, the two treated with Pyrocone-E continued to grow normally, but the two treated with BHC and one of the two treated with chlordane died within 6–11 months; the control trees were both dead in eight months. In extensive field trials throughout Kerala in 1951–53, in which naturally infested trees were each treated with Pyrocone-E by injection at 1,500 cc. for mature palms and 500–1,000 cc. for younger ones, both adults and larvae were in general completely controlled, though some trees required a second application after four months. The trees were kept under observation for a year;

those in which the growing point had been damaged did not survive, but 90 per cent. of the rest recovered completely.

Shujaatul Akbar (S.). **On Indian Insect Types. V. The Morphology and Life-history of** *Leptocorisa varicornis* **Fabr. (Coreidae, Hemiptera)—a Pest of Paddy Crop in India. Part I. Head and Thorax.**—*Aligarh Muslim Univ. Publ.* (Zool. Ser.) [1+] 53 [+9] pp., frontis., 9 pls., 63 refs. Aligarh, 1957. **Part II. Abdomen, Internal Anatomy and Life-history.**—*Op. cit.* [1+] 49 [+7] pp., 7 pls., 109 refs. 1958.

The skeleto-muscular morphology of the head and thorax of adults of *Leptocorisa varicornis* (F.), which sucks the grains and is a major pest of rice near Aligarh, Uttar Pradesh, is described in detail in the first part of this paper, and that of the abdomen in the second, which also includes descriptions of the internal anatomy and immature stages and an account of observations on the life-history of the Coreid [*cf. R.A.E.*, A **19** 296]. In the laboratory, the eggs hatched in 4–5 days during July–September and in 5–6 days during October–December, mostly at night. There were five nymphal instars, lasting 3–4, 2–3, 2–3, 4 and 5 days, respectively, at maximum temperatures of 88–101°F., minimum temperatures of 66–74°F., and 65–75 per cent. relative humidity. The adult males and females lived for averages of 33 and 55 days, with maxima of 50 and 104 days, respectively. Females did not pair for 12–14 days, but males were sexually mature soon after emergence; pairing in the field occurred mostly during the morning, although in the laboratory it was observed at night in the absence of bright light. Eggs were laid over about three days, beginning 3–4 days after pairing, at a rate of 12–19 per day, usually in 1–3 rows each containing 15–20 eggs. *L. varicornis* breeds freely on wild grasses in June–July, and migrates to rice in July–August; most damage is done at the onset of earing in September–October, or later in areas where both early and late varieties of rice are grown. The Coreid occurs on the upper parts of the plants in the morning and evening in July–October, but shelters on the lower parts between 10 a.m. and 4 p.m. In November–December, it becomes active in the late morning. Flights were short, especially those by males. The adults were inactive between December and March, and the absence of suitable food-plants usually prevents much activity until April–June. Eggs and nymphs did not survive the winter. *Cicindela sexpunctata* F. was observed preying on the nymphs and adults.

Trehan (K. N.) & Bagal (S. R.). **Life-history, Bionomics and Control of Sweet Potato Weevil (***Cylas formicarius* **F.) with short Notes on some other Pests of Sweet Potato, in Bombay State.**—*Indian J. Ent.* **19** (1957) pt. 4 pp. 245–252, 14 refs. New Delhi, 1958.

Cylas formicarius (F.), all stages of which are briefly described, causes serious injury to sweet potato in Bombay State, and investigations on its bionomics and control were made in 1946–49. The eggs of this weevil are deposited in the tuber or lower stem, the larvae begin to tunnel immediately after hatching and pupate in the burrows, and the adults remain in the latter for two days after emergence. The egg, larval and pupal stages averaged approximately 6, 16·7 and 7 days in August–September 1946 and January–February 1948 and 6·7, 18·9 and 6·1 days in March–April 1948. Adults lived for an average of 82·8 days, and males outnumbered females. *C. formicarius* is active throughout the year, but breeding is most vigorous during the

rainy season and infestation higher in August–October than in March–May. The adults cause considerable damage by feeding on the stems and mid-ribs of the leaves, and the larvae damage up to 60 per cent. of the tubers and also injure mature plants. Irrigation at 10-day intervals with heavy manuring resulted in the highest yield with the lowest injury, and normal manuring with irrigation at 14-day intervals in the highest injury and lowest yield. Dusting with 30 lb. 5 or 7 per cent. BHC per acre when the weevils were first noted and then twice at intervals of a fortnight reduced infestation just before harvest from 9 to 3·22 and 2·46 per cent., respectively, and spraying with 1·5 lb. 50 per cent. wettable DDT or BHC per 50 gal. on the same dates reduced it to 2·6 and 3·12 per cent. The use of healthy setts, deep-rooted varieties and irrigation at intervals of seven days is recommended.

Minor pests of sweet potato in the State include larvae of *Herse convolvuli* (L.), which defoliate the plants, and those of *Diacrisia obliqua* (Wlk.), which skeletonise the leaves by feeding on the lower surfaces. *D. obliqua* occurs sporadically on sweet potato but also infests other crops and is active throughout the year. In 1947–48, eggs laid on the leaves of sweet potato hatched in 4–9 days in October–January; the larval and pupal stages and the complete life-cycle averaged about 31–34, 11·5 and 51 days, respectively, and the adults survived for about five days, the females laying up to 690 eggs each. *Metriona circumdata* (Hbst.) and a species of *Aspidomorpha* skeletonised the leaves during the monsoon. The eggs of *Aspidomorpha* were deposited in masses on the leaves, the egg, larval and pupal stages lasted 9–11, 15–20 and 4–6 days, respectively, and the adults survived for an average of 58·4 days.

Patel (G. A.), Bhat (M. V.) & Gokavi (M. A.). **Investigations on Paddy Gall Midge *Pachydiplosis oryzae* (W.-M.) Mani. Part I: Annual and seasonal Variation of Incidence and Control.**—*Indian J. Ent.* **19** (1957) pt. 4 pp. 253–267, 5 graphs, 17 refs. New Delhi, 1958.

The results are given of investigations on the incidence and control of *Pachydiplosis oryzae* (Wood-Mason) on rice in North Kanara (now in Mysore State), comprising some made in 1950–54, which were the subject of a paper already noticed [*R.A.E.*, A **44** 218], and some made in 1955. The following is based largely on the authors' summary. Observations over the whole period indicate that *P. oryzae* is unimportant in the seed-bed or in winter rice, injury occurring mainly in the monsoon season, with maximum incidence between the third week in August and the second in September. Catches of adults in light-traps showed considerable variation; there were two peaks of abundance in 1950, but only one in the other years. High rainfall in late July, about a month before maximum infestation, appeared to reduce the degree of damage. Changing the water level in the field did not show promise for control. In 1955, three applications of 0·4–0·8 lb. parathion in 160 gal. emulsion spray per acre caused significant reductions in infestation and increases in yield, whereas four of 0·5 lb. dieldrin per acre in 5 per cent. pellets reduced injury but did not affect yield and 1–2 of 8 oz. endrin in emulsion spray increased yield without decreasing infestation.

Chaudhuri (R. P.). **Studies on the Methods of protecting stored Potatoes from Potato-moth Damage.**—*Indian J. Ent.* **19** (1957) pt. 4 pp. 268–278, 12 refs. New Delhi, 1958.

Gnorimoschema operculella (Zell.) caused serious damage to stored potatoes in Patna in 1953, and laboratory tests were made on its control

under Indian conditions by practices common to the country. The results showed that covering sound tubers with a one-inch layer of dry sand completely protected them, but that if any infested potatoes were covered, the infestation spread to sound potatoes beneath the cover and also to potatoes stored outside it, since some mature larvae came to the surface to pupate; adults did not penetrate the sand. Uniform thin coatings of dusts containing 0·5 or 0·65 per cent. pure γ BHC, 0·5 per cent. γ BHC as the technical product, 5 per cent. DDT, with or without pyrethrum, and 10 per cent. toxaphene or DDD all gave excellent protection of the tubers; the BHC formulations were significantly less effective than the others, with no significant differences within either group; DDD is considered safer than DDT for use on potatoes intended for human consumption. Fumigation with 1 lb. carbon bisulphide per 1,000 cu. ft. for 12 hours at 88–97°F. killed all stages of *Gnorimoschema* and did not reduce the keeping quality of the potatoes, whereas higher doses or longer exposures tended to encourage rotting.

Pant (N. C.), Gupta (P.) & Nayar (J. K.). **On the nutritional Physiology of *Latheticus oryzae* Waterhouse. I. Studies on the Feeding Response of Larvae and Adult.**—*Indian J. Ent.* **19** (1957) pt. 4 pp. 279–288, 7 refs. New Delhi, 1958.

Latheticus oryzae Waterh., a minor pest of stored products, is widely distributed in India, feeding and breeding preferably in damaged grain. In experiments, it was reared on wheat flour supplemented with yeast, which formed a favourable diet and was used as a standard, and on various seeds and dried fruits of commercial importance, which were tested for nutritional value for the larvae and adults. Growth and oviposition were normal in the flours of wheat, maize or barley, whereas neither larvae nor adults could feed on the whole grains. Adults survived for more than a fortnight, without ovipositing, on whole husked rice and pearl millet, but died within this time on most other grains and in a shorter time on the pulses and spices tested. When the grains were ground, the adults fed and produced normal eggs on most of them. The larvae showed no increase in weight on the whole grains or seeds, but fed and developed on many ground ones. The addition of yeast to materials on which there was little growth increased it substantially. The results showed the ability of *L. oryzae* to develop on diets of low moisture content, many of the foods offered containing less than 10 per cent. moisture.

Prasad (S. N.) & Prasad (A. R.). **An Experiment on the chemical Control of *Schizotetranychus* sp. (Tetranychidae: Acarina) infesting *Saccharum spontaneum* in Bihar.**—*Indian J. Ent.* **19** (1957) pt. 4 pp. 300–301, 3 refs. New Delhi, 1958.

Schizotetranychus sp. sometimes causes serious injury to plantings of sugar-cane during the pre-monsoon period in Bihar, and treatments for its control were evaluated against a heavy infestation that developed on the wild cane, *Saccharum spontaneum*, in a nursery in 1956. Counts made 48 hours after application showed that sprays containing 0·05 per cent. parathion (two formulations) caused significant mortality, whereas sprays of 0·01 per cent. Systox [diethyl 2-(ethylthio)ethyl phosphorothioate (demeton)] and 0·05 per cent. endrin and a dust of Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite] did not. Increase of population a fortnight after treatment was significantly lower for parathion than for endrin or no treatment; no other differences were significant.

Bhatia (K. R.). **Preliminary Observations on the Influence of Incubation Temperature on the Colour and Weight of Hatchlings from crowded and isolated Females of the Desert Locust** (*Schistocerca gregaria* **Forskal).**—*Indian J. Ent.* **19** (1957) pt. 4 pp. 304–306. New Delhi, 1958.

Tests are described in which egg-pods of *Schistocerca gregaria* (Forsk.), some laid by females that had been crowded for many generations and others from parents that had been isolated within 24 hours of maturing, were halved and placed in moist sand, after which the two sets of halves were incubated at temperatures of 28 and 34°C. [81·4 and 93·2°F.], respectively. The hoppers were examined within 24 hours of hatching, and it was found that, irrespective of temperature, hoppers from crowded parents tended to be heavy in weight and black in colour, whereas those from isolated ones were lighter in weight and tended to be green. The progeny of both crowded and isolated parents tended to be darker in colour and heavier after incubation at the lower temperature than at the higher. The eggs hatched in 18–20 days at 28°C. and 12–13 days at 34°C. Splitting the pods increased mortality, sometimes preventing hatching altogether.

Kobayashi (T.). **The Control of Laying Eggs of the White-spotted Longicorn on** *Citrus*, **by the new White Wash Method.** [*In Japanese.*]—*Jap. J. appl. Ent. Zool.* **1** no. 4 pp. 244–253, 3 figs., 4 refs. Tokyo, 1957. (With a Summary in English.)

Investigations in Japan on the protection of *Citrus* trees from oviposition by the Lamiid, *Anoplophora malasiaca* (Thoms.), by means of coatings of polyvinyl alcohol and polyvinyl acetate, which form insoluble membranes after evaporation of the water in which they are emulsified, showed that the coating from a wash of DDT, BHC and polyvinyl alcohol (1500) persisted for six months, but did not give complete protection after 12 days, and that two of slaked lime, containing 2·5 per cent. polyvinyl acetate and 5 per cent. polyvinyl alcohol (2000), respectively, were effective for only 21 and 31 days. A wash containing slaked lime with 5 per cent. polyvinyl alcohol (2000) and 2·5 per cent. polyvinyl acetate was very persistent, protecting the trees almost completely throughout the experiment, and was not improved by the addition of insecticide, and one of lime containing 5 per cent. of each of the polyvinyl compounds showed less than 7·8 per cent. deterioration after six months and also gave complete protection.

The wash should be applied in the first half of June, before much oviposition has occurred, and any eggs already present should be removed. Although eggs are laid mainly on old trees, young ones should also be treated, and all parts on which oviposition occurs should be covered, low-trimmed trees to a height of at least 3–4 ft. and high-trimmed ones to 8 in. above the main forks. Frequent inspections should be made to detect any eggs that have been deposited at the edges of the treated areas.

Takahashi (F.). **Synchrony between the Parasitoid Wasp and its Hosts in their interacting System.** [*In Japanese.*]—*Jap. J. appl. Ent. Zool.* **1** no. 4 pp. 259–264, 7 graphs, 10 refs. Tokyo, 1957. (With a Summary in English.)

Laboratory tests were carried out at a temperature of 30°C. [86°F.] and 70 per cent. relative humidity to determine the effect on the development of *Nemeritis canescens* (Grav.) of the age of the host larva at the time of parasitism. *Ephestia cautella* (Wlk.) was attacked throughout the larval

stage, but most parasites developed from eggs laid between the 10th and the 22nd day after deposition of the host eggs; the developmental period of the parasite varied from 37 days on young hosts to 17–18 on those more than 19 days old, and it is concluded that the parasite develops best in hosts about 19–22 days old. Both host and parasite populations fluctuate, but the synchronism between them is not perfect, owing to variations in the duration of the immature stages of the parasite. On *Plodia interpunctella* (Hb.), there is no distinct fluctuation in either host or parasite population.

TANAKA (T.). **Effects of constant Temperature on the biotic Potential of Apple-grain Aphid.** [*In Japanese.*]—*Jap. J. appl. Ent. Zool.* **1** no. 4 pp. 268–271, 2 graphs, 15 refs. Tokyo, 1957. (With a Summary in English.)

Experiments are described in which *Rhopalosiphum padi* (L.), a common pest of cereal crops in Japan, was reared in the dark on barley grown in pots at constant temperatures of 6–35°C. [42·8–95°F.] and approximately 100 per cent. relative humidity, to determine the effect of temperature on fecundity and the developmental period. The results showed that the rate of reproduction was lowest at 6°, but increased gradually with rise of temperature from 12 to 27·5°C. [53·6 to 81·5°F.] and then decreased suddenly to a minimum at 35°. There was practically no development and no transformation from the first to the second instar at 6°C., but the durations of the instars gradually decreased to a minimum at 25–27°C. [77–80·6°F.], at which the four instars lasted a total of about 90 hours, and then increased again; at 35°, hardly any aphids reached the fourth instar.

UTIDA (S.). **"Phase" Dimorphism observed in the Laboratory Population of the Cowpea Weevil,** *Callosobruchus quadrimaculatus.* [*In Japanese.*] —*Oyo-Dobuts. Zasshi* **18** pp. 161–168, 1 graph, 18 refs. Tokyo, 1954. **2nd Report. Differential Effects of Temperature, Humidity and Population Density upon some ecological Characters of the two Phases.** [*In Japanese.*]—*Res. Popul. Ecol.* **3** pp. 93–104, 9 graphs, 14 refs. Kyoto, Ent. Lab. Kyoto Univ., 1956. (With Summaries in English.)

The cowpea Bruchid, *Callosobruchus maculatus* (F.) (*quadrimaculatus* (F.)), has been found in the laboratory in Japan to have adults of two distinct forms, of which one flies and the other does not [*cf.* also *R.A.E.*, A **46** 213]. Morphological and physiological characters differentiating them are described in the first paper, in which it is stated that the non-flying form consists of both sexes, has an elongate body form with the tip of the abdomen exposed dorsally, is brownish in colour, shows a wide variation in body size, has a short adult life-span, is heavy in weight on emergence, lays many eggs, feigns death and has a weak resistance to heat, whereas the flying form consists of females only, has a short body form with the tip of the abdomen covered by the elytra, is of a tan colour and uniform body size, has a long adult life, is light in weight on emergence, lays few eggs and is comparatively resistant to heat. The two forms arise as the result of differing densities in the larval population, and are not genetically controlled.

The experiments recorded in the second paper showed that the flying form has a high rate of oviposition and long duration of life at lower temperatures and is stenothermous, in comparison with the non-flying form. Survival and fecundity in it are favoured by high relative humidity. The population density resulting in the maximum number of progeny is lower for adults of the flying form than for those of the non-flying one, while the optimum

density for individual reproduction and for the oviposition rate is higher for the flying form than for the non-flying one. As a result, the optimum range of population density for reproduction is narrow for the flying form. These findings support the assumption that the flying form is a primitive one living in the field, and the non-flying form one adapted to storage conditions.

Kiyoku (M.). **Studies on the Insect Fauna of the Japanese Pine Mushroom and the Damage due to the Insect Pests.** [*In Japanese.*]—*Sci. Rep. Fac. Agric. Okayama Univ.* no. 11 pp. 49–59, 4 figs., 15 refs. Okayama, 1958. (With a Summary in English.)

Studies on the insects injurious to the Japanese pine mushroom [*Cortinellus edodes*] in Hiroshima prefecture showed that it was attacked by 17 species of boring insects and 14 species that feed on the outer layers, lists of which are given; two nematodes and several unidentified mites were also found. The boring insects included *Drosophila bizonata* Kikkawa & Peng, *D. buscki* Coq., *D. transversa* Fall., *Megaselia* (*Aphiochaeta*) *matsutakei* (Sasaki), *Psychoda fungicola* Tokunaga, *P. nigriventris* Tokunaga, *Suillia* sp. and an unidentified Cecidomyiid, which were the most important of all the pests. Notes on the bionomics of some of these are included. The insects were most numerous in sweeps made in May–June and October–November, before and after the peak of mushroom growth.

Yu (T. F.), Pei (M. Y.) & Hsu (H. K.). **Studies on the Red-leaf Disease of the Foxtail Millet** (*Setaria italica* **(L.) Beauv.). I. Red-leaf, a new Virus Disease of the Foxtail Millet, transmissible by Aphids.** [*In Chinese.*]—*Acta phytopath. sin.* **3** no. 1 pp. 1–18, 2 col. pls., 2 figs., 37 refs. [Peking] 1957.

Yu (T. F.), Hsu (H. K.) & Pei (M. Y.). **II. Cultivated and wild Hosts of Millet Red-leaf Virus.** [*In Chinese.*]—*Op. cit.* **4** no. 1 pp. 1–7, 6 refs. 1958. (With Summaries in English.)

The authors state in the first part of this paper that outbreaks of a hitherto unknown disease have recently occurred on foxtail millet (*Setaria italica*) in northern China. It is locally referred to as red-leaf disease, but the symptoms vary with variety of millet, the leaf blades, sheaths and spikes turning red on purple-stemmed varieties, but the leaf blades becoming yellow on green-stemmed ones. In all varieties, the disease causes shortening of the internodes, stunting of the whole plant, wrinkling of the leaves, with a waviness of their margins, deformation of the spike and underdevelopment of the root system. Plants infected at an early age are severely stunted and produce no heads.

In investigations, the disease was found to be caused by a virus that was readily transmitted by *Aphis* (*Rhopalosiphum*) *maidis* Fitch, *Macrosiphum avenae* (F.) (*granarium* (Kby.)) and *Toxoptera graminum* (Rond.); feeding by uninfected aphids caused no symptoms of it. The virus was not transmissible mechanically or through the seeds or soil. Experiments with *A. maidis* showed that the virus was persistent in the aphid vector, which infected at least 27 seedlings in succession. The aphid acquired the virus in feeding periods of ten but not five minutes, an eight-hour feeding period being optimal, and transmitted it in feeding periods of not more than five minutes, a four-hour period being sufficient for maximum transmission. *Aphis gossypii* Glov., *Myzus* (*A.*) *persicae* (Sulz.) and *A. glycines* Mats. failed to transmit. The incubation period in *S. italica* was usually 14–20 days, with extremes of 10–32 days.

Many other cultivated cereals and wild grasses also show symptoms of the disease, and tests with *A. maidis* confirmed that maize, *Panicum miliaceum* and four grasses are susceptible to it, typical symptoms being produced. Spraying with parathion (E605) gave inconsistent field control of the disease. Of 349 varieties of *S. italica* tested, nine were found to be tolerant of or only slightly injured by the disease, though they were susceptible to it in aphid-transmission experiments.

The red-leaf virus appeared to differ from all previously described viruses of cereals; it resembled the yellow-dwarf virus of Oswald & Houston [*R.A.E.*, A **43** 268] in its aphid vectors and absence of mechanical transmission, but differed from it greatly in host-plant range.

In the second part, the authors state that *A. maidis* is by far the most important of the aphids found able to transmit the virus, since it is the most effective as a vector and is common in the field, and describe investigations on the host-plant range of the virus, carried out to elucidate the outbreak character of the disease. Tests were made by transferring examples of *A. maidis* that had fed on artificially infected *S. italica* to 50 species of cultivated and wild graminaceous plants in pots in cages in an insect-proof greenhouse, killing the aphids after 1–2 days, observing the plants for the development of symptoms and testing for the virus a fortnight later. From the results, 45 species of plants are classified into three groups; 23 species, including *S. italica* and several common grasses, developed symptoms of the disease, 11 showed no symptoms but were found to be infected with the virus, and the remainder developed no symptoms and were free from the virus. The last group included sugar-cane and sorghum, and further tests confirmed their immunity, so that the red-leaf virus is apparently not the same as sugar-cane mosaic, which also has a wide host-plant range among the Graminaceae [*cf.* **11** 449]. The exact relations of red leaf to yellow dwarf and sugar-cane mosaic remain to be discovered; it appears at present to be intermediate between them.

Viado (G. B.), Banaag (A. F.) & Luis (R. A.). **Planting Dates of Corn in Relation to Insect Infestation.**—*Philipp. Agric.* **41** no. 8 pp. 440–449, 9 refs. College, Laguna, 1958.

Two tests were carried out in the Philippines in the rainy seasons of 1956 and 1957 to find the effect of sowing date on insect attack on maize. The maize was sown on 26th May, 11th and 26th June, 11th and 26th July and 6th August in 1956 and on 6th and 21st June, 6th and 21st July and 6th and 21st August in 1957. *Pyrausta nubilalis salentialis* (Sn.) and *Heliothis armigera* (Hb.) were the most destructive insects present, and the second sowing was the most injured by the early generations of these moths in 1956, whereas the third sowing was most infested by *Pyrausta* and the fourth by *Heliothis* in 1957. Later sowings suffered very little injury. Infestation by *Plusia chalcites* (Esp.) was high, the second sowing in 1956 and the third in 1957 showing most damage, that by *Melanitis* (*Cyllo*) *leda* (L.) was highest in the second sowing in 1956, but increased as sowing was delayed in 1957, and *Aphis* [*maidis* Fitch] was most numerous in the first sowing and almost negligible in later ones; none of these three had been known to be so abundant on maize. *Monolepta* [*bifasciata* (Hornst.)], though sometimes important [*cf. R.A.E.*, A **30** 20], caused little damage in 1956 and none in 1957. In both years the first sowing gave the highest yield and there was a sharp decrease as the sowing date was delayed. In 1957, there were considerable and consistent decreases in percentage germination and height of plants as sowing was delayed and a rapid increase in the incidence of downy mildew from the second to the fourth sowing, with a subsequent

decrease, and it is concluded that besides insect injury, such factors as low germination, high incidence of disease and poor stand of the plants were responsible for the rapid falling off in yield with delayed sowing.

Viado (G. B.) & Labadan (R. M.). **DDT Treatment of Sack Containers for the Control of Storage Insects of Corn.**—*Philipp. Agric.* **41** no. 8 pp. 450–459, 2 figs., 6 refs. College, Laguna, 1958.

Tests were carried out in the Philippines from April 1956 to November 1957 to determine the effectiveness of impregnating sacks with DDT to protect maize stored in them from insect attack. Gunny sacks and closely-woven cotton ones were immersed momentarily in emulsified solutions containing 1, 3 or 5 per cent. DDT, dried, partly filled with dried uninfested maize, and stored at temperatures of 26·6–32·2°C. [about 80–90°F.] on open shelves in a room containing several heavily infested sacks of maize. Large numbers of *Calandra* (*Sitophilus*) *oryzae* (L.), *Oryzaephilus surinamensis* (L.) and *Plodia interpunctella* (Hb.) and small numbers of *Rhizopertha dominica* (F.), *Tribolium castaneum* (Hbst.), *Lasioderma serricorne* (F.), *Cryptolestes* (*Laemophloeus*) *pusillus* (Schönh.), *Tenebroides mauritanicus* (L.), *Araecerus fasciculatus* (Deg.), *Carpophilus dimidiatus* (F.) and *Sitotroga cerealella* (Ol.) were present in the room.

Examination after periods of 3–18 months showed no significant differences in insect numbers or loss of weight of grain between treated and untreated cotton sacks, which contained very few insects compared with those in the gunny sacks. Up to 0·8 per cent. of the kernels were damaged, and the difference between treated and untreated bags was significant only at 12 months. The closeness of the weave was evidently an important factor in preventing infestation. In gunny sacks, all three treatments caused significant reductions in numbers of insects, percentage of kernel injury after 6, 12 and 18 months and weight of grain after 18 months, with no significant difference between treatments. Kernel damage increased consistently in the treated bags, but did not reach 1 per cent., whereas 97·56 per cent. of the grain in untreated bags was infested after 18 months; *Calandra oryzae* and *O. surinamensis* were the most numerous insects, and *R. dominica*, *Tribolium castaneum*, *L. serricorne* and *Tenebroides mauritanicus* present in considerable numbers; other species were relatively scarce.

Novero (E. S.). **Biological Study of *Lymantria lunata* Cramer, (Lymantriidae, Lepidoptera), with a Consideration of its Control.**—*Philipp. Agric.* **41** no. 9 pp. 505–525, 10 figs., 2 refs. College, Laguna, 1958.

Observations were made in the Philippines in 1954–55 on the life-history and control of *Lymantria lunata* (Cram.), all stages of which are described in detail. The larvae of this Lymantriid feed on the leaves of *Citrus* and other plants, sometimes causing complete defoliation, especially on young trees, and are abundant from late October to early March, reaching their maximum numbers during December and January. The females oviposited 1–3 times, laying 86–874 eggs in irregular masses on the leaves. The eggs hatched in 7–10 days, and the larval stage lasted 38–51 days. The larvae fed on the upper leaf surface until the third instar, when they ate the whole leaf except the veins and midrib. The full-fed larvae ceased feeding 1–2 days before pupation, and the pupal stage lasted 8–12 days. Adult females lived for 9–14 days and males for 6–9 days. Six generations were reared between November 1954 and December 1955. In addition to *Citrus*, 15

species of plants were found to be infested in the field. Two parasites, *Brachymeria* sp. and a Tachinid, were reared from field-collected material.

Sprays containing 0·05 and 0·2 per cent. dieldrin, DDT or lead arsenate, applied to infested *Citrus* plants, gave complete mortality of the larvae in about 144 and 96 hours, respectively. At 0·1 per cent., DDT killed all the larvae in 96 hours, and dieldrin and lead arsenate in 120 hours. When the larvae were placed on sprayed trees, all three insecticides gave complete mortality in 144 hours at 0·05 per cent. and in 120 hours at 0·2 per cent.; lead arsenate gave complete control in 144 hours and dieldrin and DDT in 120 hours at 0·1 per cent.

Muller (R.). **Le dépérissement des pisquins, arbres d'ombrage du caféier arabica au Cameroun (régions Bamoun et Bamiléké).**—*Agron. trop.* **14** no. 1 pp. 13–17, 6 figs. Paris, 1959. (With Summaries in English & Spanish.)

Lavabre (E.). **Deux dangereux parasites des " pisquins ".**—*T. c.* pp. 18–22, 6 figs. (With Summaries in English & Spanish.)

Malformation and withering of *Albizia malacocarpa*, which is used as a shade tree in coffee plantations in the west of the French Cameroons, has become widespread there in the past ten years. Observations in 1954 showed that it was due principally to attack by *Pachystola mamillata* (Dalm.); a Cerambycid, *Xystrocera nigrita* Serv., was associated with this Lamiid in some instances, but contributed little to the damage. The first of these papers contains an account of the injury and the way in which it is caused, and the second comprises short descriptions of the adults and larvae of both species, information on their distribution and habits and on the plants they attack and suggestions for control of *Pachystola*.

The eggs of *P. mamillata* are deposited in bark crevices at the base of the trunk or on the large roots near the soil surface, and the larvae bore into the current year's growth of the trunk, collar or roots, forming galleries 8–16 in. long and increasing in width to nearly an inch as the larva grows; these cut off the flow of sap, causing the death of part of the tree if attack is localised and of the whole tree if the trunk is girdled. Withering is not evident until a quarter or a third of the circumference of the trunk is damaged, and one side of the tree will grow if only one tenth of the circumference is intact; young trees are rapidly killed, but older ones survive for some years. Pupation takes place in a cell in the wood, and the adult emerges more than two months later through a hole situated directly above the entrance hole. Attacks may occur within 12–20 in. above the ground or in the big roots in any healthy trees that provide sufficient nourishment; trees less than 3–4 years old are too small, and dead trees are not attacked. *P. mamillata* is present in all stages throughout the year and has spread rapidly over large areas from the original centre of infestation.

X. nigrita develops in the same way, but its attacks occur higher up the trunk or on the main branches, and the adults emerge through the larval entrance holes. Infestation is sporadic and is responsible for less than 10 per cent. of the total destruction of *A. malacocarpa*.

The measures recommended for control of *P. mamillata* comprise a soil treatment against females approaching the trees to oviposit and a bark treatment against the young larvae in their galleries. The collar and roots should be exposed to a depth of 12–20 in., the excavated soil mixed with at least 8 oz. dust containing 10 per cent. aldrin, BHC or chlordane per tree and the treated soil heaped against the trunk after the collar, roots and lower trunk have been brushed with about 3½ pints concentrated insecticide emulsion, such as 1 part 20 per cent. dieldrin in 10 parts water, particularly where

entry holes can be found. The treatment is most lasting if made at the end of the rainy season, and it should be repeated regularly, particularly on healthy or lightly attacked trees.

Lavabre (E. M.). **Le scolyte des branchettes du caféier robusta** *Xyleborus morstatti* **Haged.**—*Café, Cacao, Thé* **2** no. 3 pp. 119–130, 7 figs., 11 refs.; **3** no. 1 pp. 21–33, 7 figs., 10 refs. Paris, 1958–59.

Xyleborus morstatti Hag. is an important pest of coffee in the French Cameroons. It prefers *Coffea robusta* and causes little damage to *C. arabica*, but as the former is the easier to grow in Africa and is increasing in importance in French territories, attack by the Scolytid is becoming of more consequence, causing about 20 per cent. loss of crop. *X. morstatti* bores in the current year's twigs, killing them in a few weeks or causing them to break from the weight of the crop; it weakens and retards the fruiting of young plants and makes the necessary replacement of trees very difficult. Removing and burning infested twigs is no longer an adequate measure of control.

The adults of both sexes of *X. morstatti* are described in detail, and characters are given distinguishing it from *Stephanoderes hampei* (Ferr.). In rearing tests, eggs were laid 7–8 days after the female had entered the twig, the egg, larval and pupal stages averaged about 4–5, 11 and 7 days, respectively, the adult tegument hardened in two days and the females reached sexual maturity in about six days. There were about nine times as many females as males, and mating took place in the gallery, which the males never left. The newly fertilised female flew or crawled in search of a suitable twig, in which it bored a new gallery; the eggs were deposited at random in this, in several groups over a period, so that the inhabitants of a single one varied considerably in stage of development, and the larvae, which passed through two instars, fed on the conidia of the fungus (*Monilia*) introduced by the parent female; from special tests it seemed likely that this had to pass through the beetle before the spores could germinate in the gallery.

Lindane [γ BHC], dieldrin and endrin were the most effective of a number of organic insecticides tested against the adult females in the laboratory, and two applications of aqueous sprays of dieldrin or endrin at suitable rates afforded satisfactory protection to young trees (2–4 years old) in the field in the dry season. It is pointed out, however, that populations are decreasing at that season, and that treatment would be more effective in June–July, when they are increasing. Aqueous sprays would not be adequate in the rainy season, and the insecticides should then be applied in oil sprays. Older trees would require uneconomic doses, but are less subject to attack than young ones and rarely require treatment.

Schmitz (G.) & Crisinel (P.). **La lutte contre** *Stephanoderes hampei* **Ferr.**—*Publ. Inst. nat. agron. Congo belge* Sér. sci. no. 70, 156 pp., 4 pls., 8 pp. refs. [Brussels] 1957.

The authors review the literature on the importance and distribution of species of the genus *Stephanoderes*, describe the damage caused to coffee by *S. hampei* (Ferr.), give details of the seasonal cycle of this Scolytid in coffee plantations in Uele district, in the north-east of the Belgian Congo, and discuss its life-history [*cf. R.A.E.*, A **25** 193] and its natural enemies, which have proved of no importance in this area. The females oviposit and the larvae develop in the seeds of the ripening coffee fruits, and the attack was found to be responsible for most of the shedding of fruits that occurs, the rest being due to fungi and physiological causes.

Investigations on control were made in the laboratory and in the field in Uele, and a parallel series, described by J. Decelle, in the Congo Basin [*cf.* **44** 453]. These are described in detail, and those in other parts of the world reviewed [*cf.* **41** 253, etc.], and it is concluded that in Uele, treatments should be applied from towards the end of April until the end of June, or until the end of July if ripening is slow. They should be applied before mid-May if *Dichocrocis crocodora* (Meyr.) is also present on the trees, but can be delayed until the better weather of June in its absence, although some fruits will then be lost by shedding. Endrin is the most effective insecticide against both insects, but should not be applied without mist sprayers to deliver it at a distance from the operator, as it is toxic to man. Parathion is very effective against *Stephanoderes*, but may not give complete control of *Dichocrocis*, since it does not persist for more than 48–72 hours on the leaves. BHC is also effective against *S. hampei*, but DDT, toxaphene or other insecticides should be added to it if *D. crocodora* is present. Doses of 0·54 lb. endrin and 0·72 lb. γ BHC or parathion in about 107–111 gal. spray per acre have proved effective for ordinary spraying; if spraying is not practicable, 2–3 applications of dust are about as effective as one of spray. Methods of application are described, and the economic value of treatment is discussed in some detail.

Additional investigations on *D. crocodora* [*cf.* **41** 15] showed that endrin, dieldrin, toxaphene and DDT are effective for its control, whereas BHC and chlordane are not. Methods of application are discussed, and it is concluded that DDT gives very good results at low doses if applied evenly with power sprayers, but that lead arsenate is almost as effective and cheaper if only hand sprayers are available, as application is then necessarily uneven. DDT should be applied 1–2 or 2–3 times a year, respectively, in 0·5 and 0·25 per cent. sprays and lead arsenate up to three times at 0·5 per cent. Endrin gave promising control at much lower doses than DDT and was more effective than dieldrin. If water is not available, two applications of about 30 lb. 10 per cent. DDT dust per acre are fairly effective.

Schmitz (G.). *Helopeltis* **du cotonnier en Afrique centrale.**—*Publ. Inst. nat. agron. Congo belge* Sér. sci. no. 71, 178 pp., 3 pls. (2 col.), 26 figs., 14 pp. refs. [Brussels] 1958.

Helopeltis schoutedeni Reut. is one of the most important pests of cotton in Uele district, in the north-east of the Belgian Congo. It also attacks castor (*Ricinus communis*). The scope of the genus and the habits of the species of it are reviewed, the distribution of the African species is shown on a map in relation to altitude and rainfall, and a key is given for their separation. *H. bergrothi* Reut., which is close to *H. schoutedeni* morphologically [*cf. R.A.E.*, A **41** 14–15, etc.], also occurs on cotton there but is not of economic importance on it; its bionomics and food-plants and its relations with *H. schoutedeni* are discussed, mainly from the literature.

H. schoutedeni is polyphagous, but races adapted to particular regional floras probably exist. Feeding is concentrated on young growth, and the rate of infestation of cotton varies with the availability of other food-plants in a suitable stage of growth during the five months between cotton seasons. Investigations in central Uele showed that the preferred plants, in order of decreasing importance, are *Ficus vallis-choudae*, sweet potato (*Ipomoea batatas*), *Smilax kraussiana*, *I. kentrocarpa*, *Vitex* sp., *I. involucrata*, peppers (*Capsicum annuum*) and *Phyllanthus floribunda*. Many other plants afforded temporary food, and, in the insectary, eggs were laid and nymphs developed on most of them. In other areas in Uele, *Acalypha ornata*, *Bersama* spp.,

Harungana madagascariensis and species of *Jussieua* serve as local reservoirs, and various cultivated leguminous, solanaceous and euphorbiaceous plants also play a significant part in maintaining populations.

Eggs are laid in incisions made by the ovipositor, usually singly and seldom in groups of more than three. Young tissues are selected, and on cotton the stems and later the petioles were preferred; 0·2 per cent. of the eggs were laid in leaf-veins on plants 60–100 days old. Usually only 2–3 eggs were laid on a young plant, up to six on plants 50 days old, and up to 10 on older plants. The eggs hatched in an average of 12–14 days on cotton at Bambesa, but the period was shortened in rainy weather. The five nymphal instars, which are described, lasted 3–5 days each on cotton in the field, resulting in a total average nymphal period of 21–22 days, as compared with 15–21 days in the laboratory at 25°C. [77°F.] and 100 per cent. relative humidity. The period was not greatly different on other food-plants, except that it was extended to 31 days on *F. vallis-choudae* in the laboratory and to 30 days on *Alchornea yambuyaensis* and 32 on *Leea guineensis* in dry seasons. Not more than about 40–45 per cent. of the nymphs reached the adult stage. Males and females became sexually mature 48 and 24 hours, respectively, after the final moult. Males paired successively with several females, but many died after mating only once; their maximum life on cotton was 55 days in the field and 38 days in the laboratory. Maximum life-spans are given for males on 22 other food-plants. Oviposition began 3–15 days after the final moult; it was discontinuous, and fertile eggs were laid by some females for two months after pairing. The longest period of uninterrupted oviposition was 14 days, during which 4–8 eggs were laid per day, with a maximum of 27. The total number of eggs laid depends on the life-span of the female. On cotton, under favourable conditions, females were found to live for 21–70 days, during which time they laid an average of 67 eggs each; in the laboratory, 23 females laid 252 eggs during the first ten days, 627 during the next 20 days and 18 subsequently. Unfertilised females survived for 43 days; some oviposited, but the eggs did not hatch. On cotton and *Jussieua* almost all the fertilised eggs hatched. The average numbers of eggs laid by females of each of the three generations observed on castor between September 1950 (rainy season) and February 1951 (dry season) were, respectively, 147, 62 and 45; 60–70, 30–40 and 30–40 per cent. hatched, and the parent females lived for 37, 28 and 26 days. Similar data for *H. schoutedeni* on other food-plants, and for other species of *Helopeltis*, based on the literature, are given in tables.

The time required for cotton fields to become infested from a given source varied with the distance to be covered, ranging from 13–17 days at about 220 yards to 54–66 days at 1,640 yards, and the intervention of forest frequently prevented infestation. In a region in which *H. schoutedeni* was present in only small numbers, with no definite infestation centres, cotton from seed sown in late June was not usually infested until late July or August. The infestation levels reached are discussed in relation to environment and sowing date. Generally, a single peak of 60–600 insects per 1,000 plants was reached in November, 100–140 days after sowing, but it was sometimes preceded by a lesser peak of about 40 insects per 1,000 plants. Extended peak populations were associated with late sowing in mid-August. The damage caused by feeding, which occurs on all the aerial parts of the plant, is described. That to the developing bolls is the most serious, since it results in shedding. Total damage to these was in direct proportion to the degree of infestation and ranged from 3·4 to 83 per cent. for populations varying from 12 to 850 insects per 1,000 plants on cotton sown in June, and from 20·1 to 92 per cent. for populations ranging from 27 to 612 per 1,000 plants on that sown in July.

Changes in the mineral constitution of the soil have shown little promise

as possible means of control. Parasites are unimportant, although in October 1946 *Euphorus anates* Nixon [*cf.* **34** 296] parasitised 20 per cent. of the nymphs and 8 per cent. of the adults. Eggs on *Bersama* were once found to be parasitised by *Lathromeris* sp., and about 0·1 per cent. of the adults are infested by a Mermithid. The destruction of beds of *Jussieua abyssinica* at Bambesa was of value in control, since the succession of generations of *H. schoutedeni* was interrupted and reinfestation was slow. The uprooting of old cotton plants each February from 1951 reduced the number of insects collected from a single plot from 3,970 in 1950 to 265 in 1955. Such action is recommended for use in rural areas, in conjunction with chemical methods. The collection of nymphs at fortnightly intervals was of value only when carried out for at least two months. Preliminary trials with insecticides gave inconclusive results because of the movement of populations between treated and untreated plots. Later tests on isolated plots established the value of dusting with DDT or toxaphene. Field applications of dusts of 10 per cent. DDT were made in September 1954, as soon as the population exceeded 10 insects per 1,000 plants. In two localities, the infestation was reduced from 7·5 to 0·6 and from 2·6 to 0·2 per cent., respectively, but a second application was required in some areas, in late October, because of reinfestation as a result of prolonged rain. In 1955, average infestation was reduced from 2·4 to 0·35 per cent. by the use of insecticides, and in 1956, when 15 per cent. toxaphene dust was used, it was reduced from 4·5 to 0·2 per cent. by a single application.

Report of the West African Timber Borer Research Unit, 1955–58.—62 pp., frontis., 1 pl., 4 figs., 2 maps. London, 1959.

In this second report [*cf. R.A.E.*, A **46** 408], the results are given of further investigations, carried out in 1955–58, on the ambrosia beetles (Scolytids and Platypodids) that infest native timbers in Ghana and Nigeria, and the following is based on the general summary of the results. Over 40 species have now been identified and their food-plant range and preferences studied. Of the commoner Platypodids, most belong to the genus *Doliopygus*, and *Xyleborus* spp. constitute most of the Scolytids. No marked food-plant specificity was observed, and none of the trees tested was immune from attack, though some were only lightly infested. The significance of certain silvicultural practices in permitting the rapid increase of populations is discussed, and it is shown that there is a seasonal variation in the population of any one species on the wing, this being correlated with the wet and dry seasons. Flight at low levels in the forest appeared to be directional, incident light possibly being a determining factor. The beetles are either crepuscular or entirely nocturnal in habit, or fly only at single limited periods during the day. Saturation deficit appeared to be of importance in determining this. Gallery patterns are generally specific for each beetle species, and the depth of radial penetration fairly constant, in the absence of rapid drying. The smaller species (mainly Scolytids) penetrate significantly less deeply than do the larger Platypodids. The degree of penetration is of importance in assessing relative pest status. From the presence or absence of tarsi (which are often lost by the older adults) and the setae covering the thorax and abdomen, it is possible to decide whether a beetle has established a gallery or is newly emerged.

Insecticide trials showed that γ BHC is superior, at any normal concentration, to aldrin, dieldrin, endrin, DDT or creosote for the protection of logs from attack, giving over 90 per cent. protection for up to 14 weeks at 0·75 per cent. Emulsified solutions are highly effective on logs devoid of bark, and oil solutions, which are more expensive, are not significantly better,

except where, as in Nigeria, the logs are subsequently transported by floating. Formulations of γ BHC in resin or grease were no more effective or persistent than solutions in oil. Fuel oil, applied to logs with the bark on, rendered them more attractive to the beetles than untreated logs.

A survey of sawmills, timber yards and docks in Ghana showed that eight Bostrychids and a Lyctid are common and important pests of sawn timber. Dipping the timber in a water mixture of 1–2 per cent. sodium pentachlorophenate, an equal amount of borax (as a buffer) and 0·5 per cent. γ BHC gave good protection against the beetles and stain fungi.

Observations on *Hypsipyla* sp. boring the shoots of *Khaya senegalensis*, which is heavily infested in nurseries and plantations in northern Ghana, indicated two main periods of infestation, corresponding with the two flushes of the leaves. *K. ivorensis* is similarly attacked in southern Ghana.

Emsley (M. G.). **A Technique for the Examination of the Feeding Mechanism in phytophagous Heteroptera.**—*Proc. R. ent. Soc. Lond.* (A) **33** pt. 4–6 pp. 93–94, 3 figs., 1 ref. London, 1958.

A modification of an earlier method [*R.A.E.*, A **42** 345] for electrocuting phytophagous Heteroptera while feeding, to permit investigation of the feeding mechanism, is described. Unlike the previous method, it requires no prior conditioning or disturbance of the insects, and it can even be used in the field.

Greathead (D. J.). **Notes on the Life History of** *Symmictus flavopilosus* **Bigot (Diptera: Nemestrinidae) as a Parasite of** *Schistocerca gregaria* **(Forskål) (Orthoptera: Acrididae).**—*Proc. R. ent. Soc. Lond.* (A) **33** pt. 7–9 pp. 107–119, 1 pl., 14 figs., 15 refs. London, 1958.

In December 1953, Nemestrinid larvae were found parasitising hoppers of *Schistocerca gregaria* (Forsk.) in marching bands in the Ogaden Province of Ethiopia, where an adult male of *Symmictus flavopilosus* (Big.) had been taken before the hoppers hatched. In January 1954, further larvae, from which adults identified as *S. flavopilosus* were reared, were found in Kenya and, since they were almost identical with those from Ethiopia, the latter are also assumed to be referable to *S. flavopilosus*, which may be a synonym of *S. costatus* Lw. [*R.A.E.*, A **18** 530]. Eggs and first-instar larvae were not seen, but the second-, third- and fourth-instar larvae, the pupa and the larval respiratory tube are here described, chiefly from material from Ethiopia. Larvae in the last three instars were found in hoppers of the third, fourth and fifth instars and in fledglings. The total period spent in the host was probably 9–14 days. On leaving the host, the larvae quickly entered sand. Larvae kept in sand in jars in the field until the end of January 1954 and subsequently at the Anti-Locust Research Centre, London, failed to pupate, although the sand was moistened occasionally, and died after several months, but when five others from Kenya were kept in England in wet sand near a lamp in a room maintained at 30°C. [86°F.], two pupated and in 10–12 days gave rise to adults, the others remaining in diapause. The life-cycle probably resembles those of *Neorhynchocephalus sackeni* (Will.) and *Trichopsidea clausa* (O.-S.) in the United States [*cf.* **40** 164]. Percentage parasitism varied from 11 to 34 in samples of about 100–340 hoppers collected in Ethiopia and from 0·2 to 2·6 in samples of about 100–500 collected in Kenya. Other hosts included the grasshoppers, *Aiolopus savignyi* (Krauss) and *Sauracris* sp., of which the last hides under the bark of dead trees and would therefore be readily attacked if the parasite females resemble those of the North American species in ovipositing in holes and cracks [*cf.* **20** 593].

In general, each *Schistocerca* hopper contained only one parasite larva, but three each containing two were found in one sample; hoppers containing more than one probably do not survive for long, and only one parasite matures per host. The appearance and activity of the host remain normal until the parasite reaches the fourth instar, when it consumes the fat-body and its bulk distends the host and prevents it from feeding. Few hoppers appear to survive parasitism, and only one of 1,138 dissected in Ethiopia and two of 1,135 dissected in Kenya showed evidence (the presence of a respiratory tube) of previous attack. Indications of retarded development caused by parasitism were provided by the high proportion of parasitised hoppers (29 of 32 dissected) among fourth-instar stragglers from a band in the main part of which the ratio of fifth- to fourth-instar individuals was 827:3 and only one of 104 fifth-instar hoppers was parasitised, and, in a fledgling band, by the significantly higher proportion of parasitism found among hoppers in the early fifth instar than in those in the late fifth instar or in fledgling adults.

Matthee (J. J.) & Oberholzer (J. J.). **The Sorghum Midge.**—*Fmg in S. Afr.* **34** no. 5 pp. 17, 19, 1 fig. Pretoria, 1958.

The sorghum midge [*Contarinia sorghicola* (Coq.)] was recently discovered in South Africa on the Springbok flats, where poor set of seed of sorghum (kaffir corn) over the previous three years had been diversely attributed to poor pollination and damage by aphids or birds. This Cecidomyiid was reported in the Sudan, where it now destroys as much as 25 per cent. of the crop, in 1930 [*cf. R.A.E.*, A **24** 441] and subsequently spread southward, reaching Nyasaland in 1950 [**41** 319], Uganda in 1951 [**41** 318], and Tanganyika in 1952 [**41** 319]. It was reported in Nigeria in 1953 [**41** 319], and after its initial discovery in South Africa was also found near Potchefstroom. Notes on its appearance and life-cycle are given, with recommendations for control by cultural methods. At Springbok, it increases rapidly between the second week in January and mid-March, but is almost completely eliminated towards the end of March by parasites or predators. Sorghum planted not later than mid-November escapes infestation.

Joffe (A.). **Moisture Migration in horizontally-stored Bulk Maize: the Influence of Grain-infesting Insects under South African Conditions.**—*S. Afr. J. agric. Sci.* **1** no. 2 pp. 175–193, 6 figs., 13 refs. Pretoria, 1958. (With Summaries in Afrikaans & French.)

The following is virtually the author's summary. The problem of surface spoilage in grain stored in untreated and undisturbed bulks is regularly encountered in South Africa and elsewhere. The spoilage results from an accumulation of moisture in the surface layers of grain. This is mainly caused by the existence within a bulk of large temperature gradients, which set up convection currents and cause a migration of moisture. In view of the relatively mild climatic conditions in South Africa, it was thought that severe temperature gradients and consequent surface spoilage in maize should not occur, provided that heat-producing grain insects were eliminated from the grain mass. In order to test this hypothesis, horizontal bulk storage experiments were conducted at four representative sites. At each site, two similar bulks of maize were stored; the one bulk was fumigated with methyl bromide and thereafter sprayed with insecticides, while the other was untreated and allowed to develop a normal insect infestation. At two of the sites, serious infestations by insects, chiefly *Calandra oryzae* (L.) and *Tribolium* spp., became established in the untreated maize during the first year of storage, and in the autumn grain temperatures in the interior of the bulks

increased steadily in spite of a drop in air temperature. At the beginning of winter the surface of the untreated maize had become mouldy and " caked ", the grain being so wet in parts that individual kernels even sprouted. In contrast, the fumigated grain remained dry, cool and in sound condition during this time. At the remaining two test sites, the insect populations in the untreated grain became established only in the second year of storage, and moisture accumulation became evident in the summer when extreme grain temperatures were recorded. Once again the fumigated maize remained in sound condition. The results indicate that the safe storage of undisturbed, horizontally-held bulk maize is possible for prolonged periods without the use of mechanical ventilation, provided that grain-infesting insects are controlled. The conclusion is reached that some of the beneficial results obtained in other countries with the use of low-volume mechanical ventilation installations may partly be due to the inhibitory effect of the cool or dry ventilating air on the activity of insects present in the grain.

Hassanein (M. M.) & Zaki (M. M.). **Studies on the Effect of certain Chlorinated Insecticides on some Insects of stored Food Products.**—*Ann. agric. Sci.* **2** no. 1 pp. 7–22, 7 figs., 7 refs. Cairo, 1957. (With a Summary in Arabic.)

Pure p,p′DDT and γ BHC were compared in the laboratory in three ways for toxicity to adults of *Calandra oryzae* (L.), *Tribolium confusum* Duv. and *Rhizopertha dominica* (F.). When the beetles were sprayed in petri dishes in a Potter tower with various concentrations of the insecticides in acetone and confined on the sprayed surface for one day, it was estimated from the results that 50 and (in brackets) 75 per cent. kills of *Calandra*, *Tribolium* and *Rhizopertha* were given by deposits of 1·45 (2·28), 1·83 (2·1) and 1·72 (1·85) mg. per sq. cm. for DDT and 0·47 (0·73), 0·74 (0·94) and 0·8 (1·01) mg. for γ BHC, respectively. When the insects were confined for 0·5–24 hours on filter papers that had been impregnated with solutions of 0·08–1·6 mg. DDT or 0·016–0·3 mg. γ BHC per sq. cm. and allowed to dry for an hour, DDT seldom gave more than 50 per cent. kill, but γ BHC acted more rapidly, giving complete mortality of *Calandra* in 20 hours and of the other two insects in 24 hours at 0·3 mg. When the filter papers were similarly impregnated but left in the light and air for 2–12 days and the insects were confined on them for 24 hours, both insecticides lost effectiveness, the activity of DDT decreasing by about 60 per cent. and that of γ BHC by up to 66 per cent. in 12 days.

Papers noticed by Title only.

Calcagnolo (G.) & Leiderman (L.). **As pulverizações concentradas no combate ao " bicho-mineiro " das fôlhas do cafeeiro, *Perileucoptera coffeella* (Guérin-Méneville) (Lepidoptera-Buccolatricidae).** [Concentrated Sprays in the Control of the Coffee Leaf-miner, *Leucoptera* (*Perileucoptera*) *coffeella* (Guér.) in São Paulo.]—*Arq. Inst. biol.* **24** (1957) pp. 105–121, 13 refs. São Paulo, 1958. (With a Summary in English.) [*Cf. R.A.E.*, A **47** 138.]

Callahan (P. S.). **Behavior of the Imago of the Corn Earworm, *Heliothis zea* (Boddie), with special Reference to Emergence and Reproduction.**—*Ann. ent. Soc. Amer.* **51** no. 3 pp. 271–283, 7 figs., 11 refs. Washington, D.C., 1958.

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